United States Patent [19]

Ohtsuka

[11] **Patent Number: 4,766,461**

[45] **Date of Patent: Aug. 23, 1988**

[54] **APPARATUS FOR PROJECTING, RECORDING AND COPYING AN IMAGE IN AN ELECTROPHOTOGRAPHIC SYSTEM HAVING MECHANISMS FOR SIMULTANEOUSLY PROJECTING AND RECORDING THE SAME IMAGE**

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[73] Assignee: **Fuji Photo Film Co., Ltd.**, Kanagawa, Japan

[21] Appl. No.: **32,809**

[22] Filed: **Apr. 1, 1987**

[30] **Foreign Application Priority Data**

Apr. 1, 1986 [JP] Japan 61-075161

[51] **Int. Cl.**[4] **G03G 15/00**

[52] **U.S. Cl.** **355/5;** 355/8; 355/11; 355/45; 355/66

[58] **Field of Search** 355/5, 8, 11, 44, 45, 355/66

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,526,456 9/1970 Sage et al. 355/5
3,926,518 12/1975 Berry et al. ..... 355/14 E

Primary Examiner—R. L. Moses
Attorney, Agent, or Firm—Sughrue, Mion, Zinn, Macpeak, and Seas

[57] **ABSTRACT**

In a projecting, recording and copying apparatus for use in an electrophotographic system, a movable mirror of a narrow width capable of traveling in the direction of its width and swiveling about its longitudinal axis is used so as to reflect a portion of the light rays shone by an image-forming optical system, thereby forming an image on the photosensitive material provided on the surface of a drum. The light rays passing by the movable mirror are focused on a screen. Since the movable mirror is moved in a swiveling manner, it is possible to project an image onto the screen and at the same time to form the same on the photosensitive material by means of a single mirror.

11 Claims, 27 Drawing Sheets

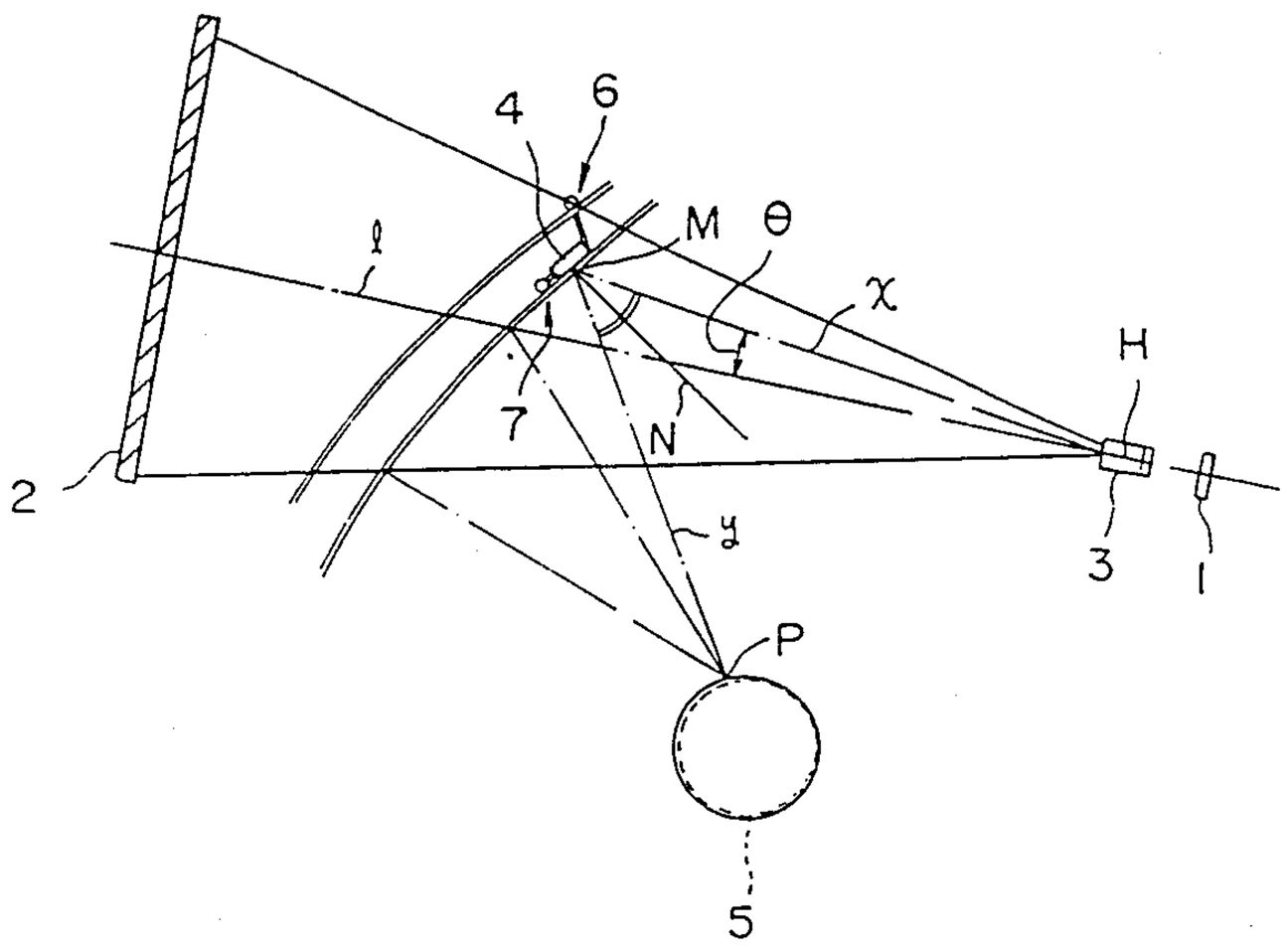


FIG-1

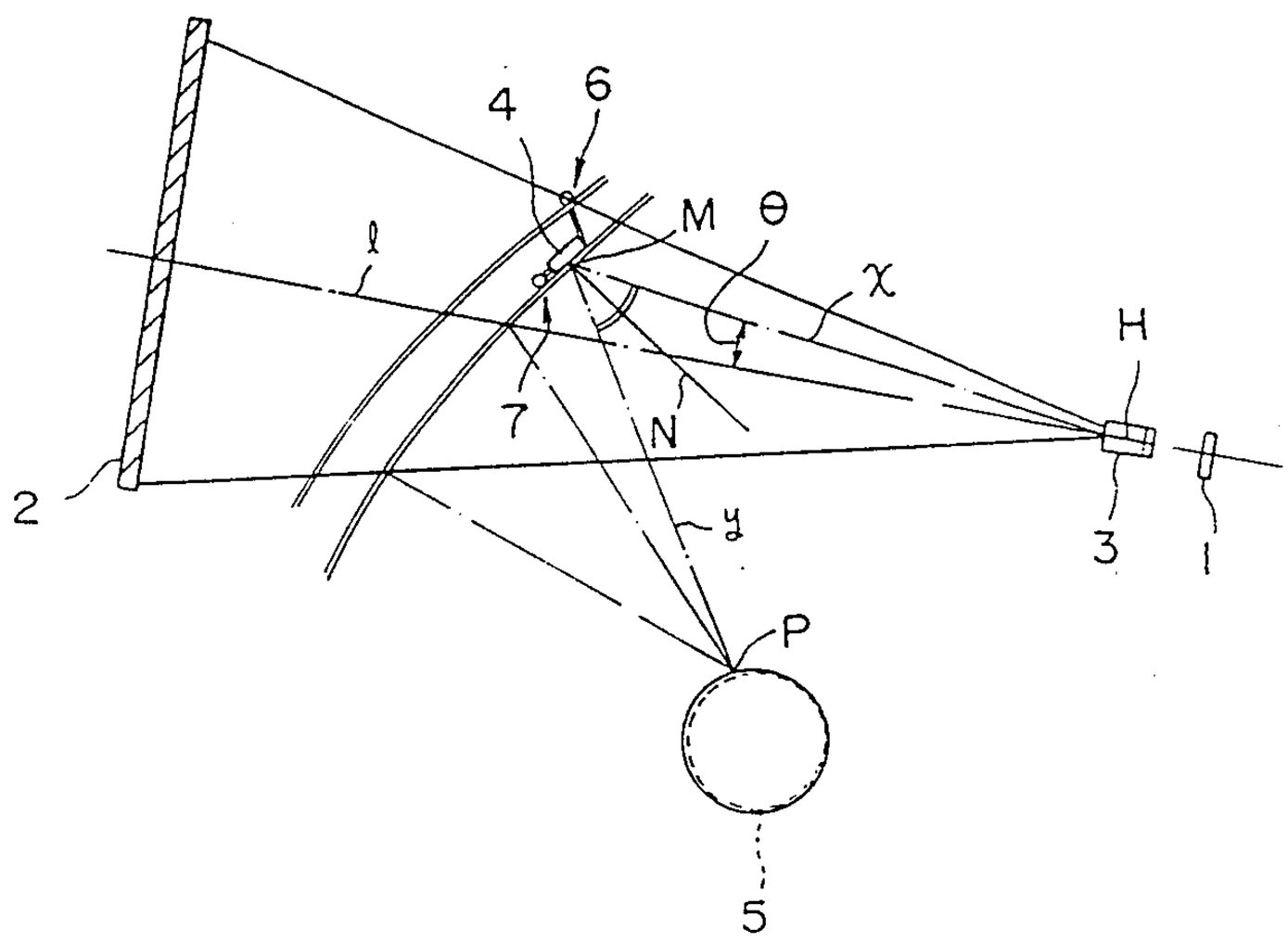


FIG-2

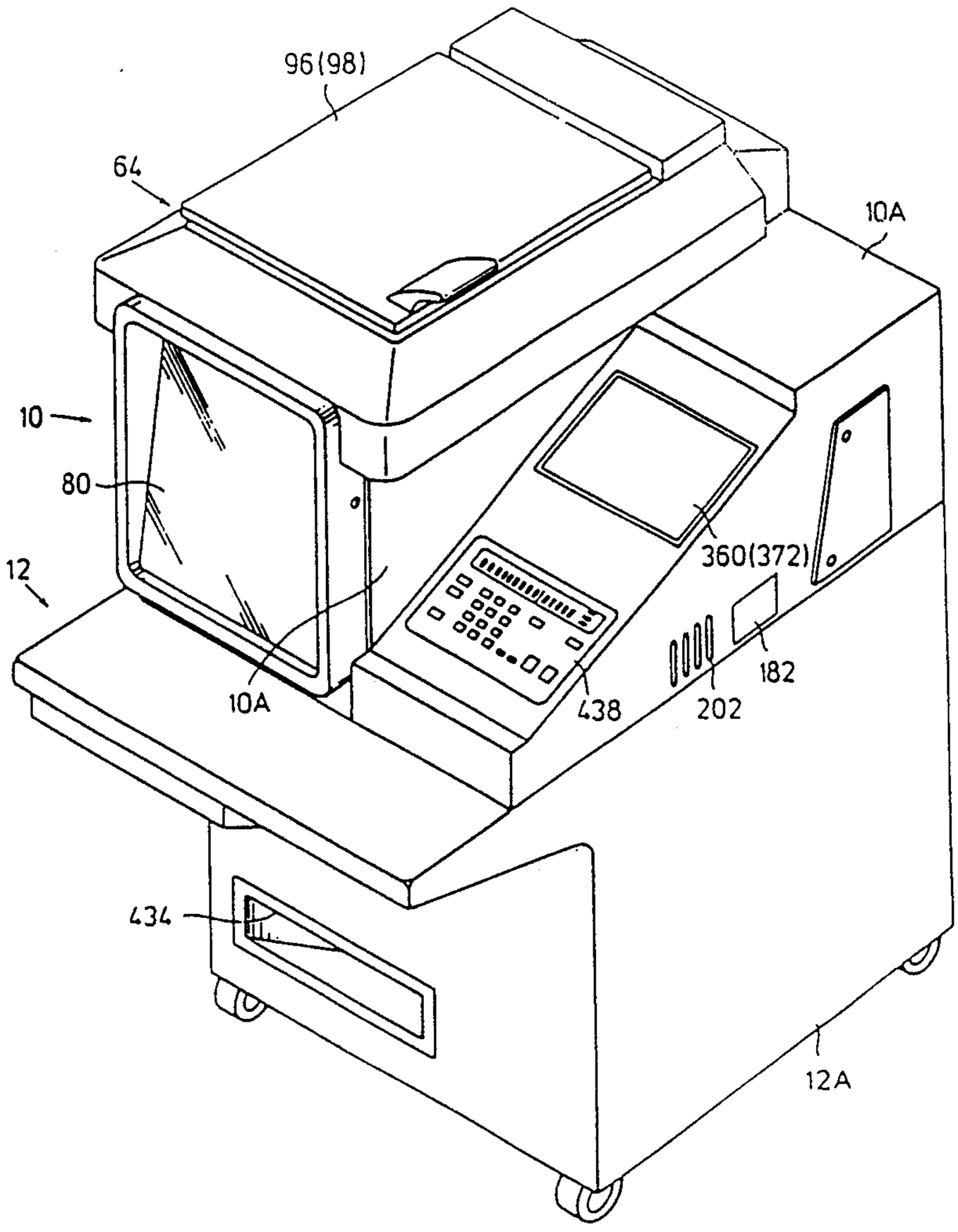


FIG-3

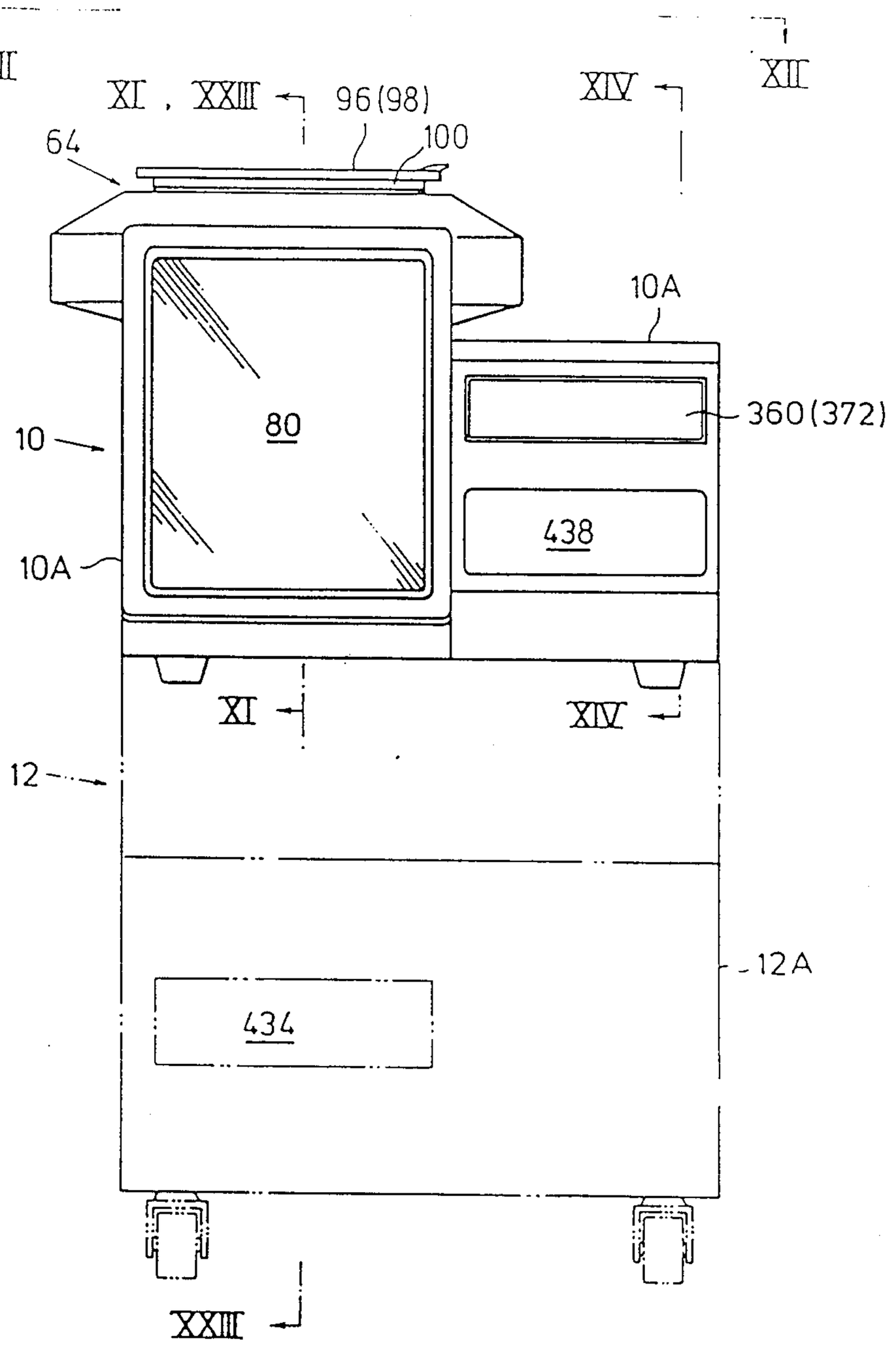

XII
XI , XXIII
96(98)
100
64
XIV
XII
10A
360(372)
80
10
438
10A
XI
XIV
12
12A
434
XXIII

FIG-4

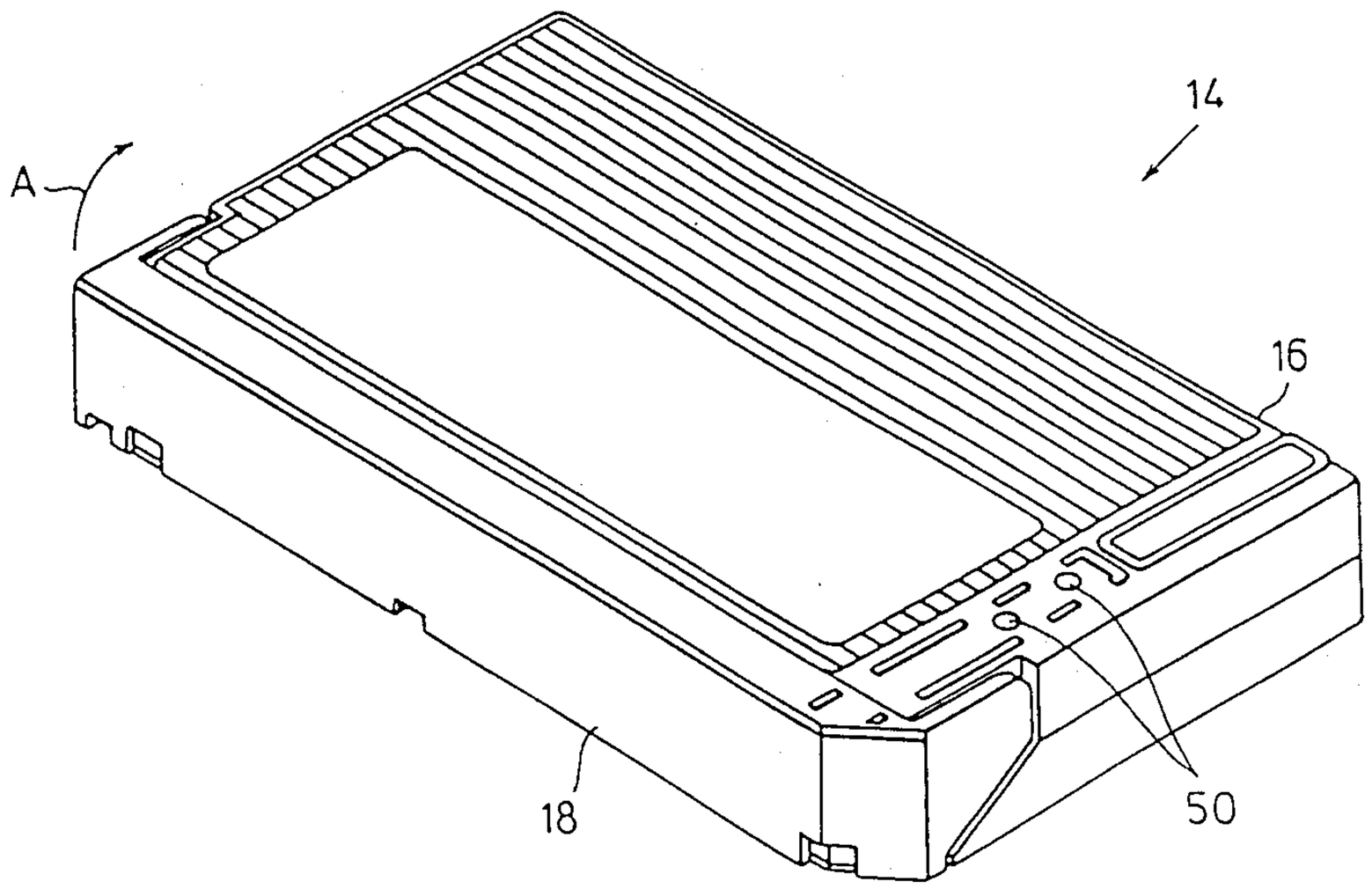


FIG-5

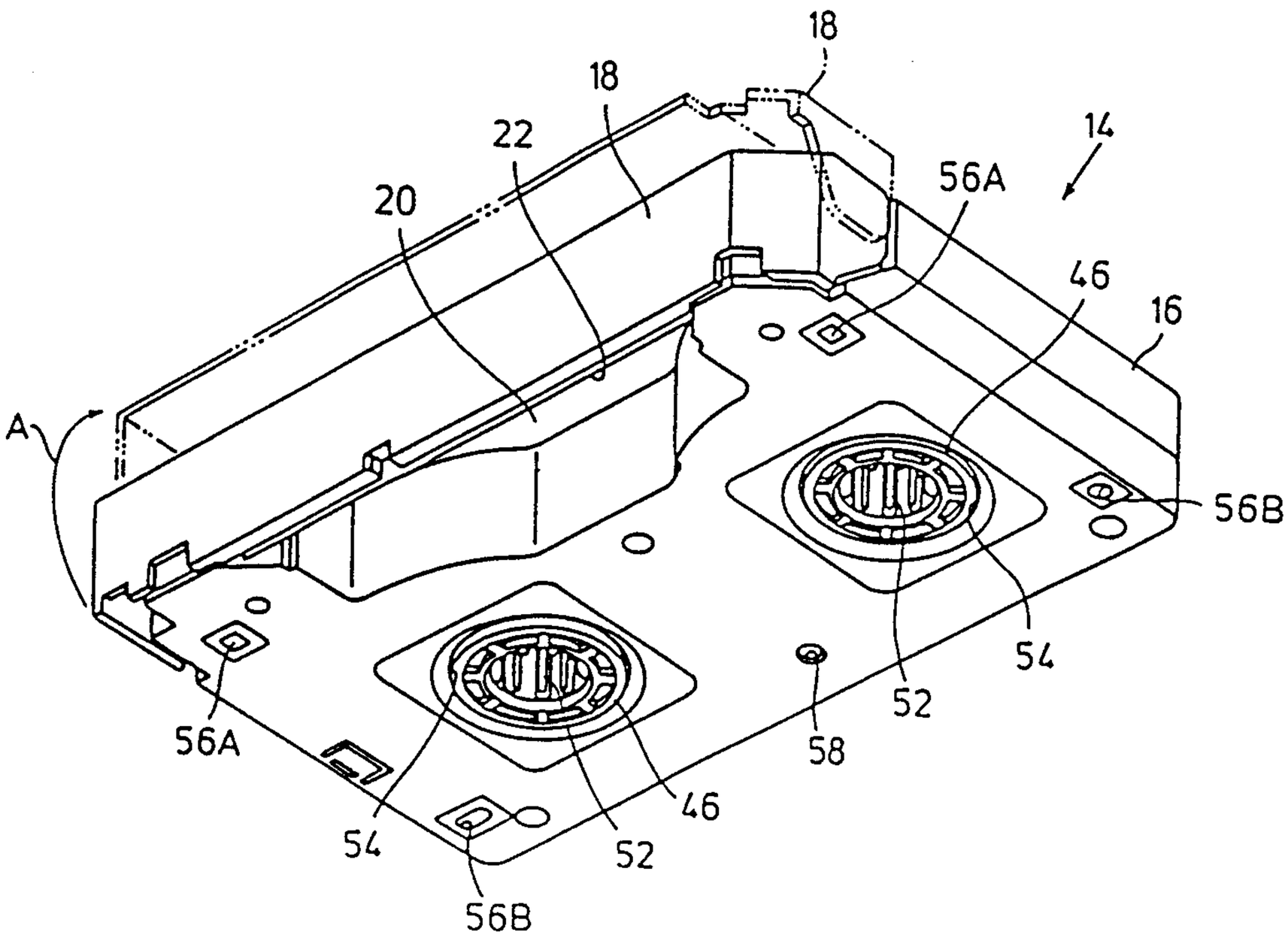


FIG-6

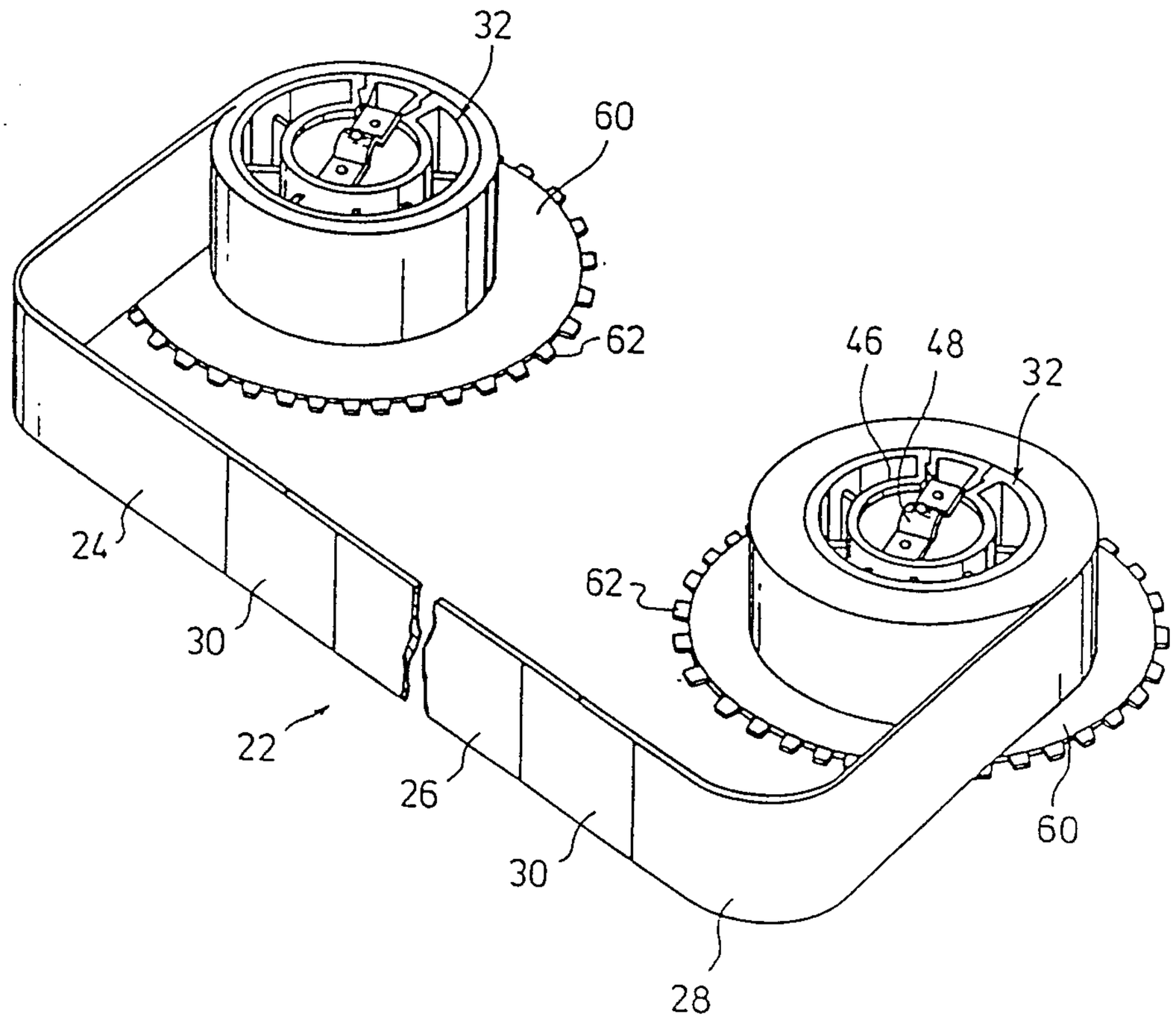


FIG-7

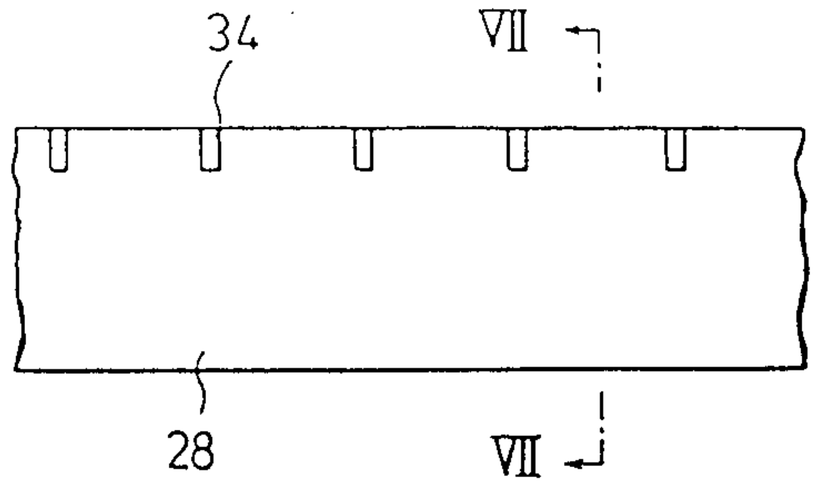


FIG-8

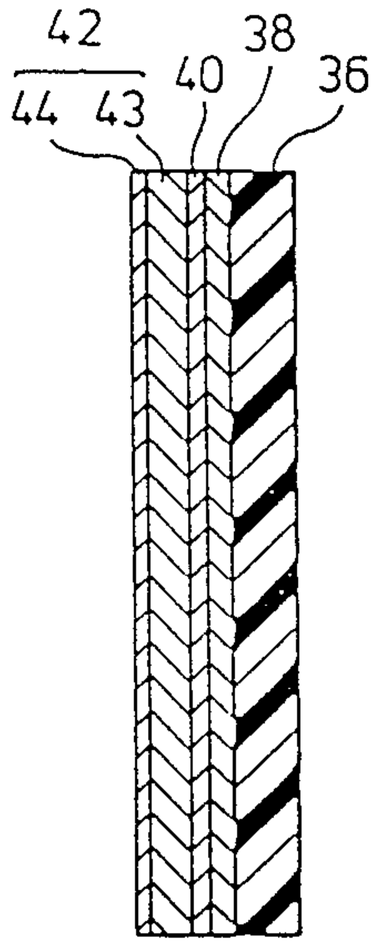


FIG-9

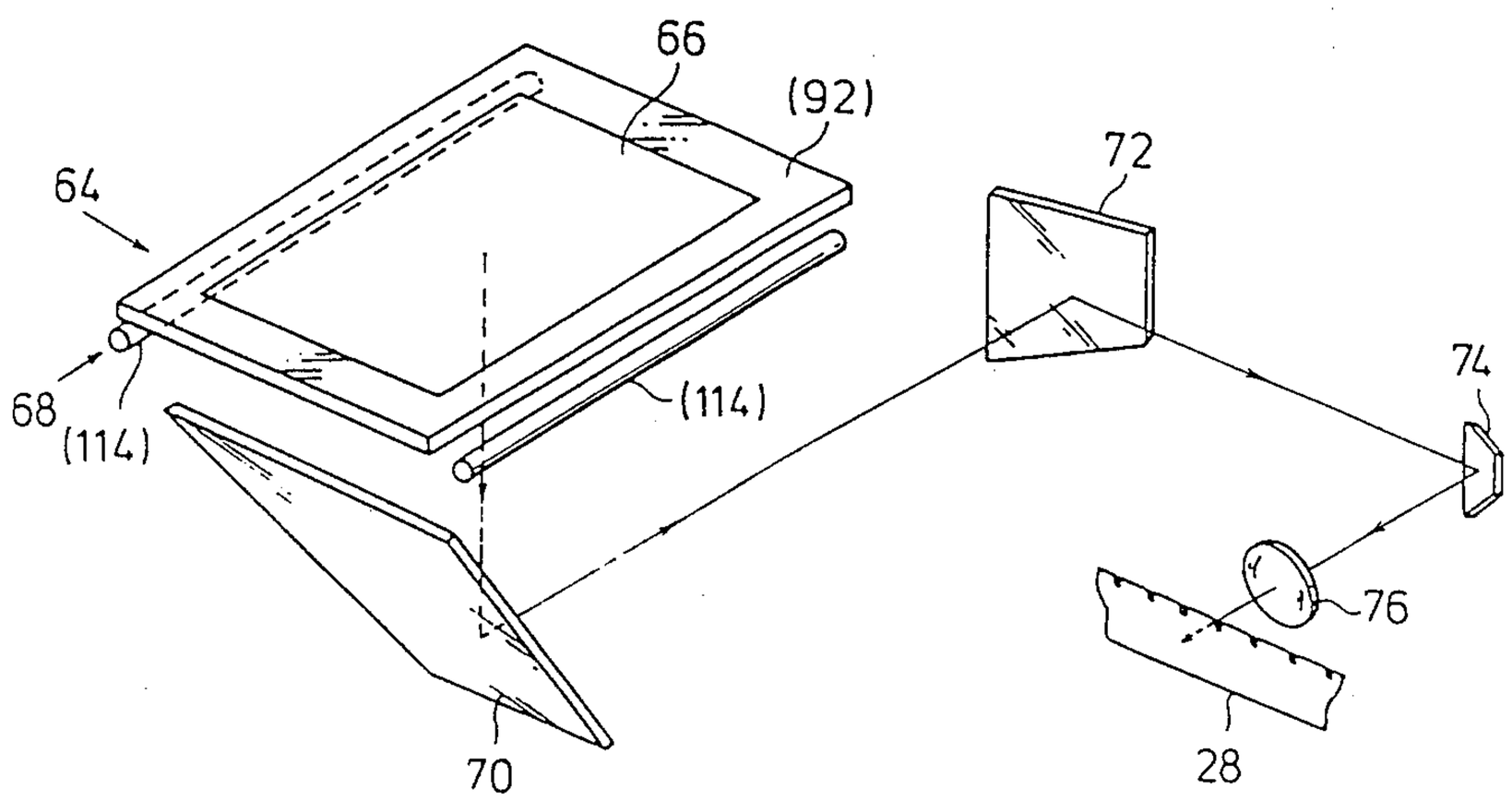
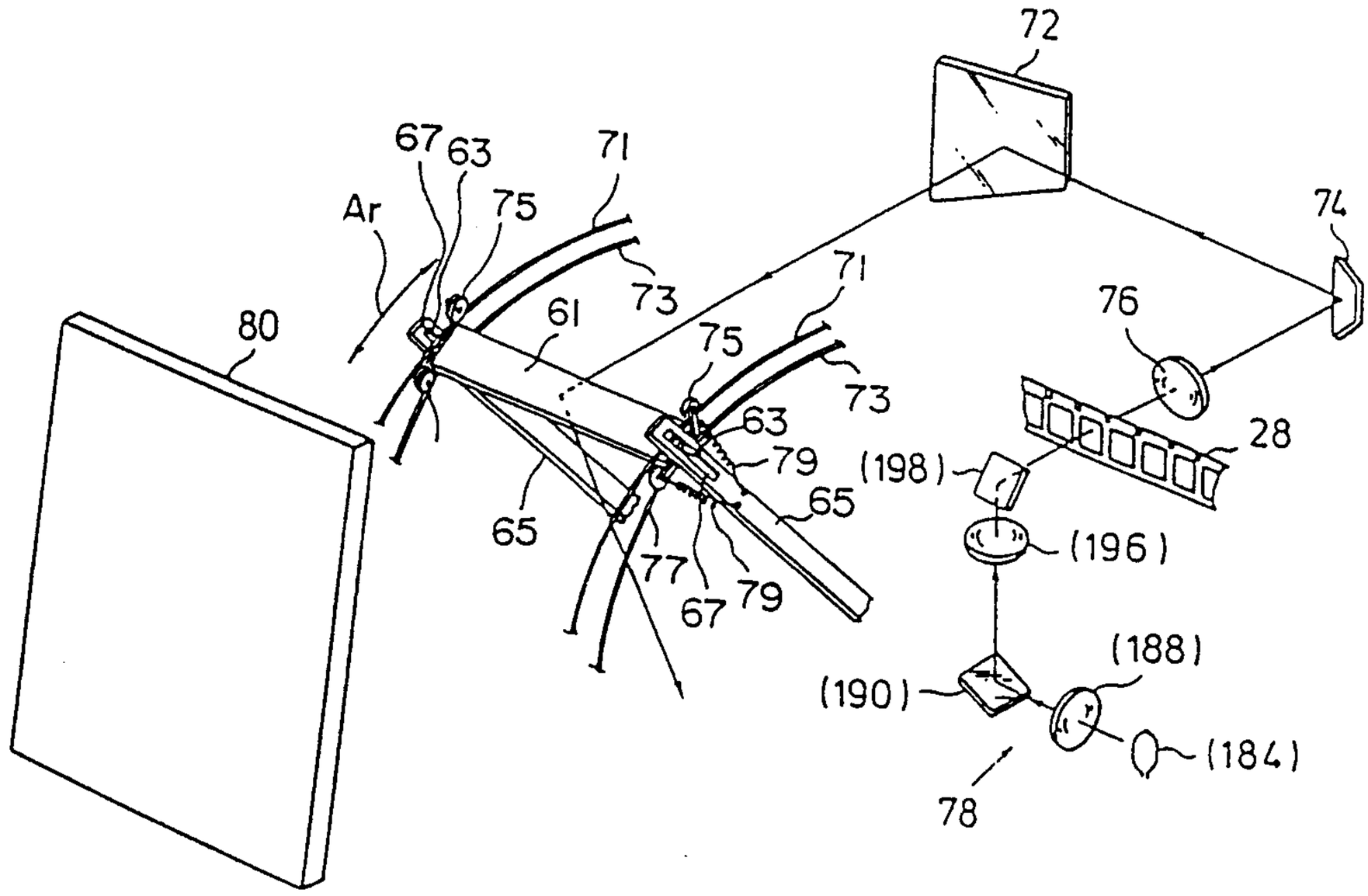


FIG-10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Ar
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74
71
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61
73
76
75
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63
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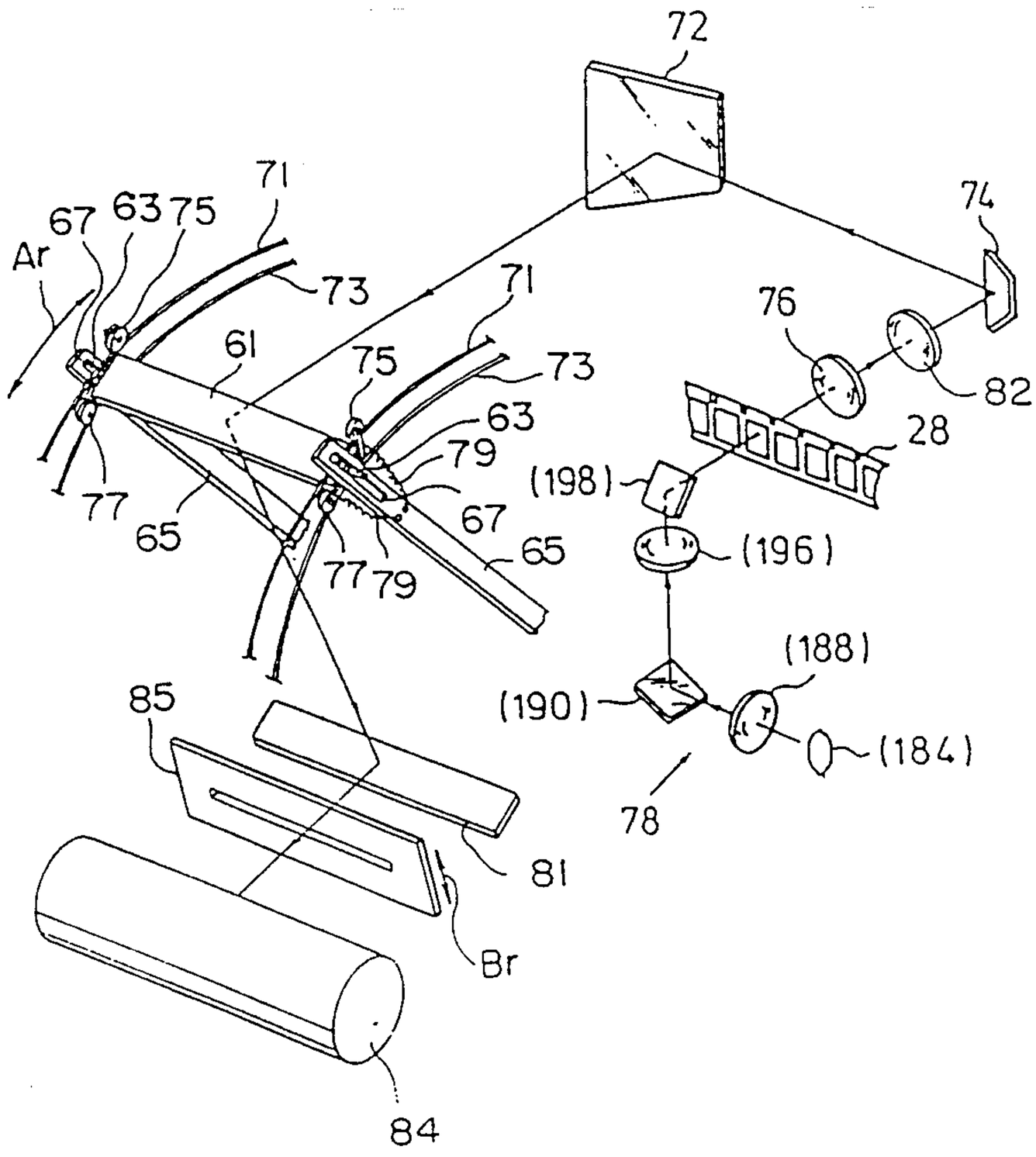
79
(198)
65
65
(196)
77
67
79
(188)
(190)
(184)
78

FIG-11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75
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82
63
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(198)
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(196)
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79
(188)
85
(190)
(184)
78
81
Br
84

FIG-12A

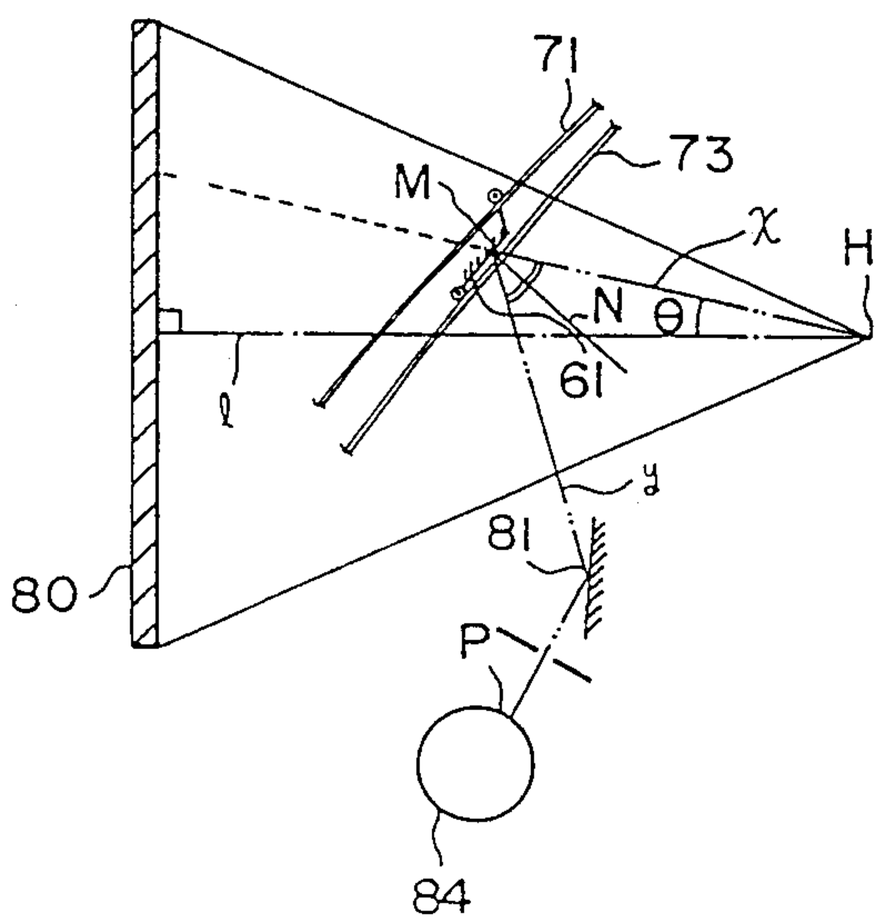


FIG-12B

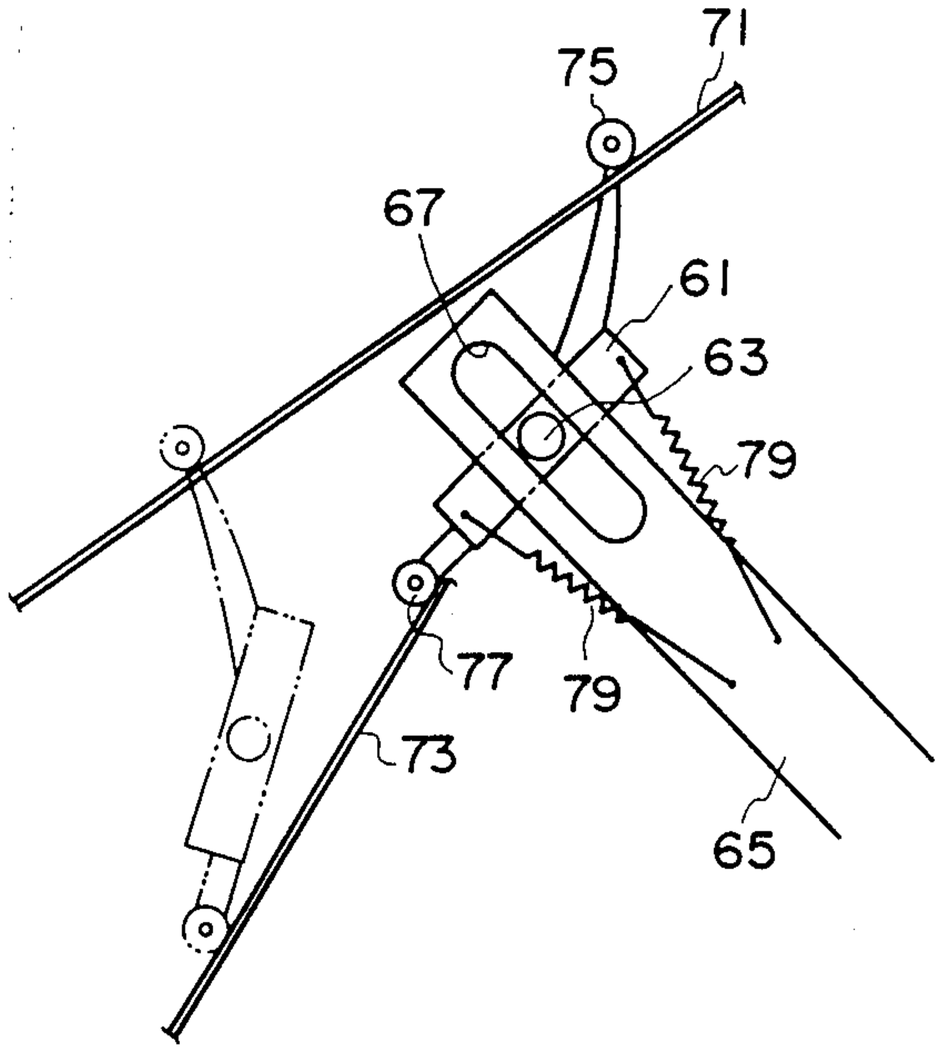


FIG-12C

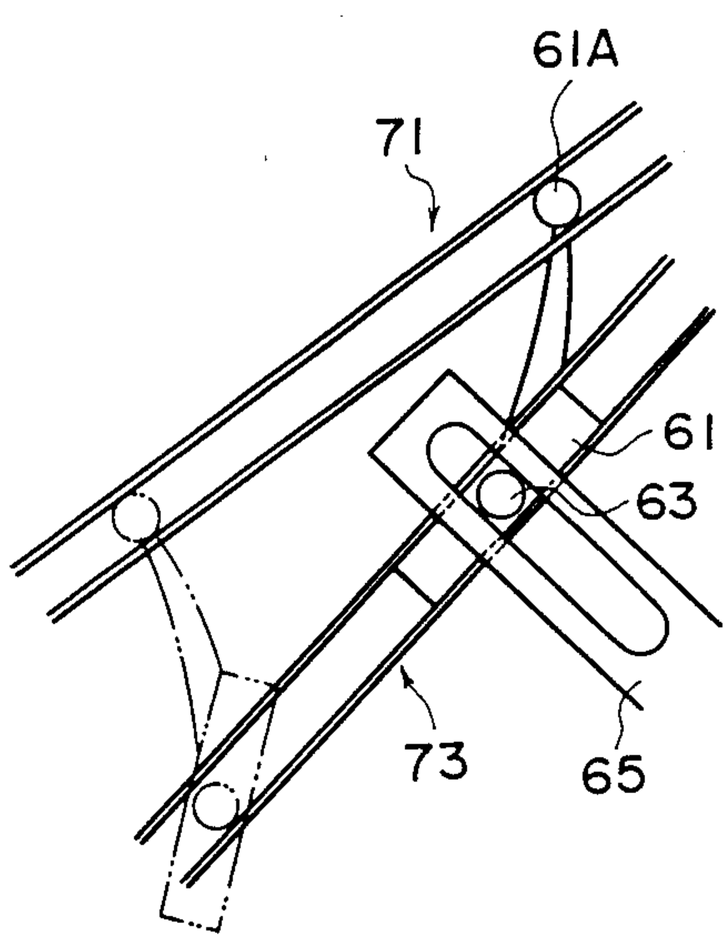
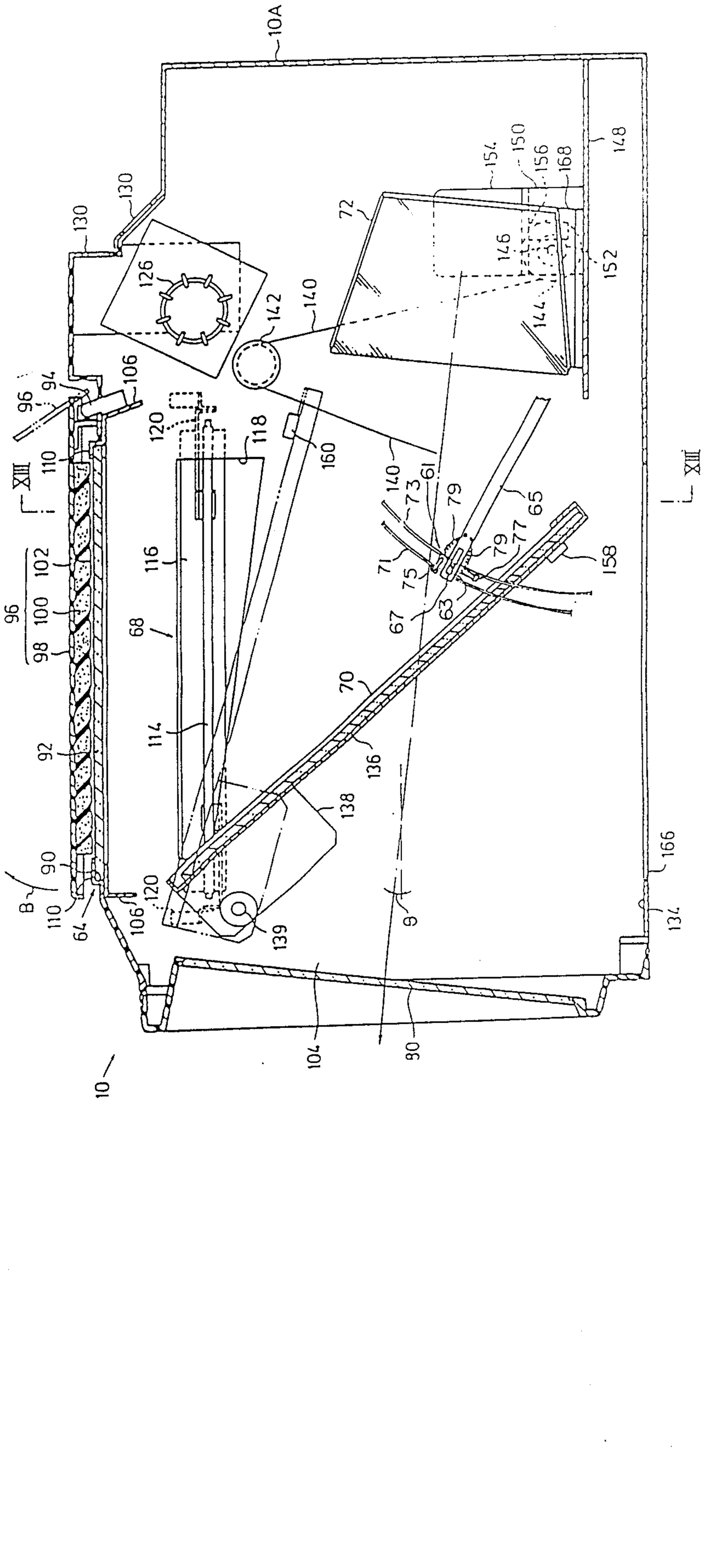


FIG - 13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118
160
XIII
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100
98
116
68
92
114
136
138
139
90
64
106
120
104
30
10
154
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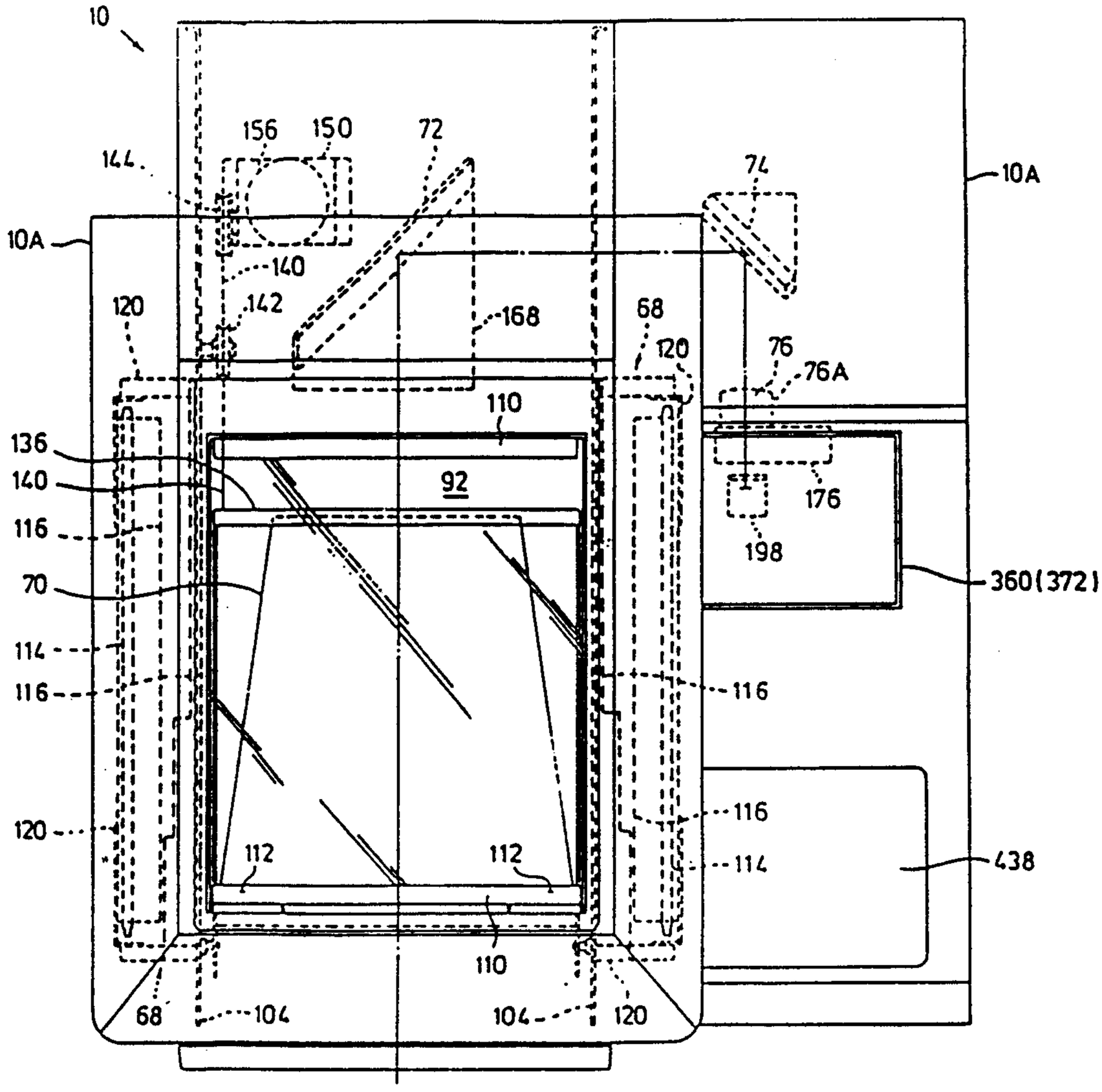
70
166
134

FIG - 14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10A
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76A
110
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92
176
116
198
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360(372)
114
116
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116
120
112
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438
114
110
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104
104
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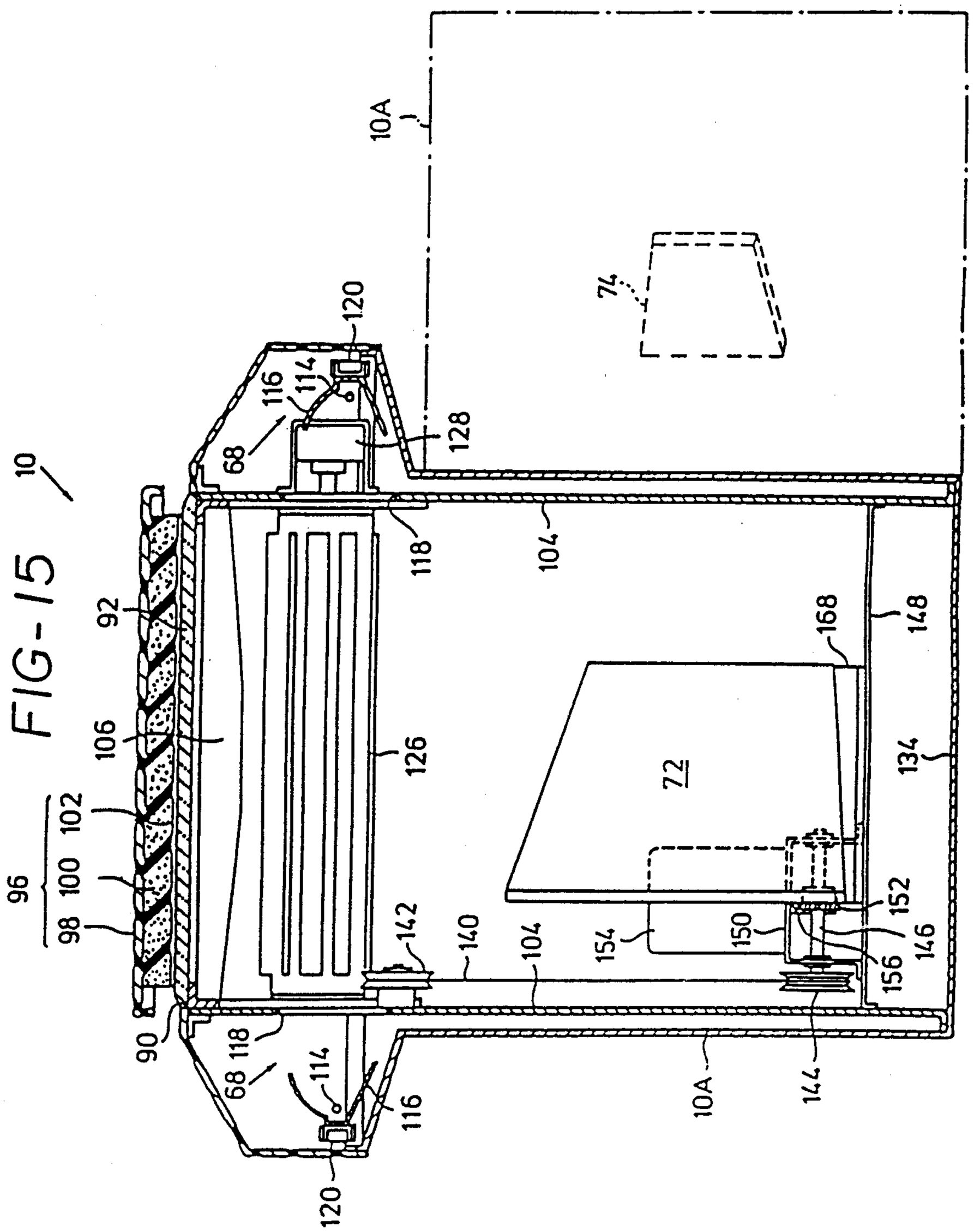
FIG-15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10A
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120
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114
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168
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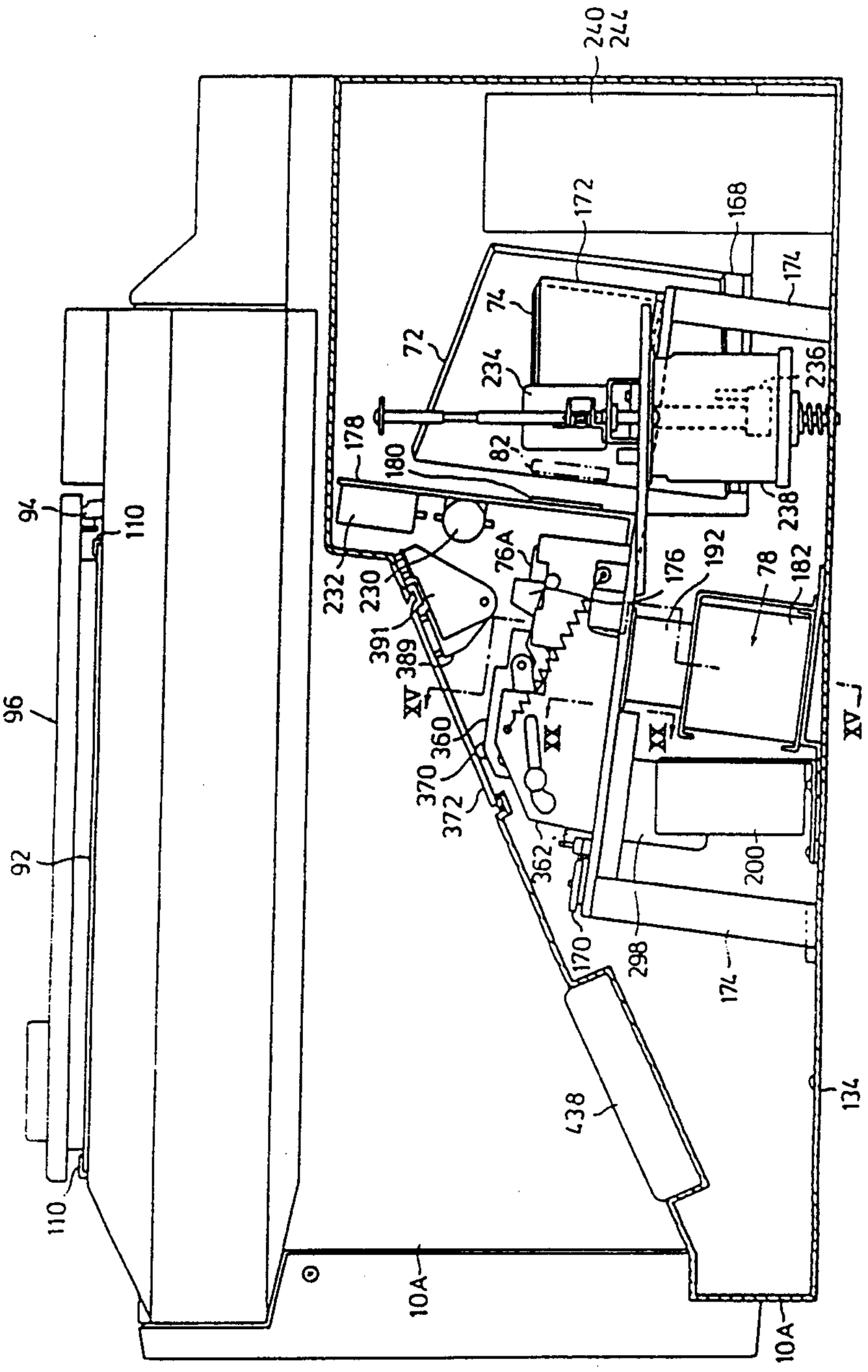
134
72

FIG-16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168
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234
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178
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76A
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182
232
230
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389
XV
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XI
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372
362
200
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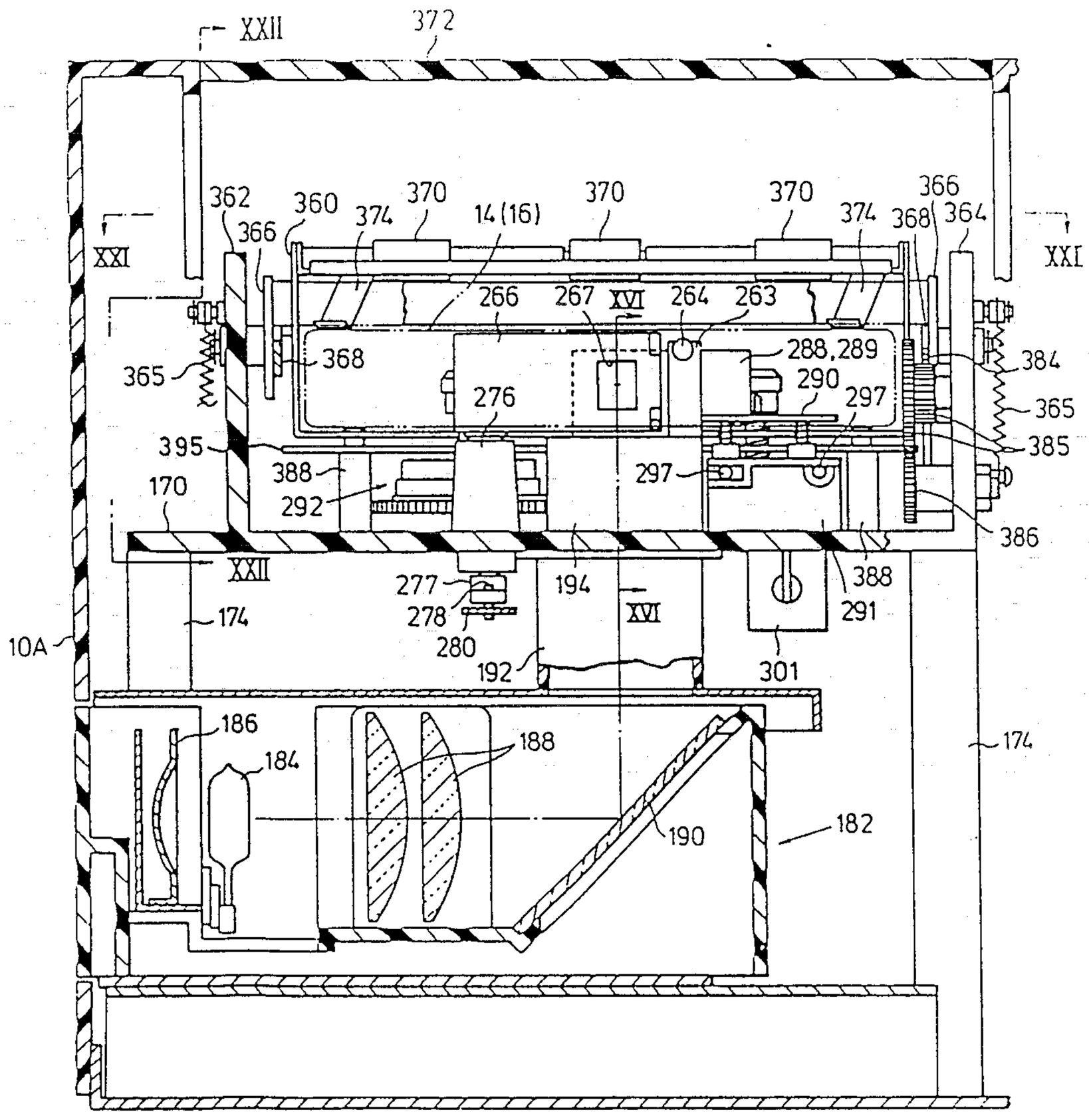
438
134
10A
10A

FIG - 17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372
362
360
374
370
14(16)
370
370
374
366
368
364
XXI
XXI
366
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XVI
264
263
288,289
290
297
384
365
385
386
365
368
276
395
388
292
170
297
XXII
277
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XVI
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10A
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301
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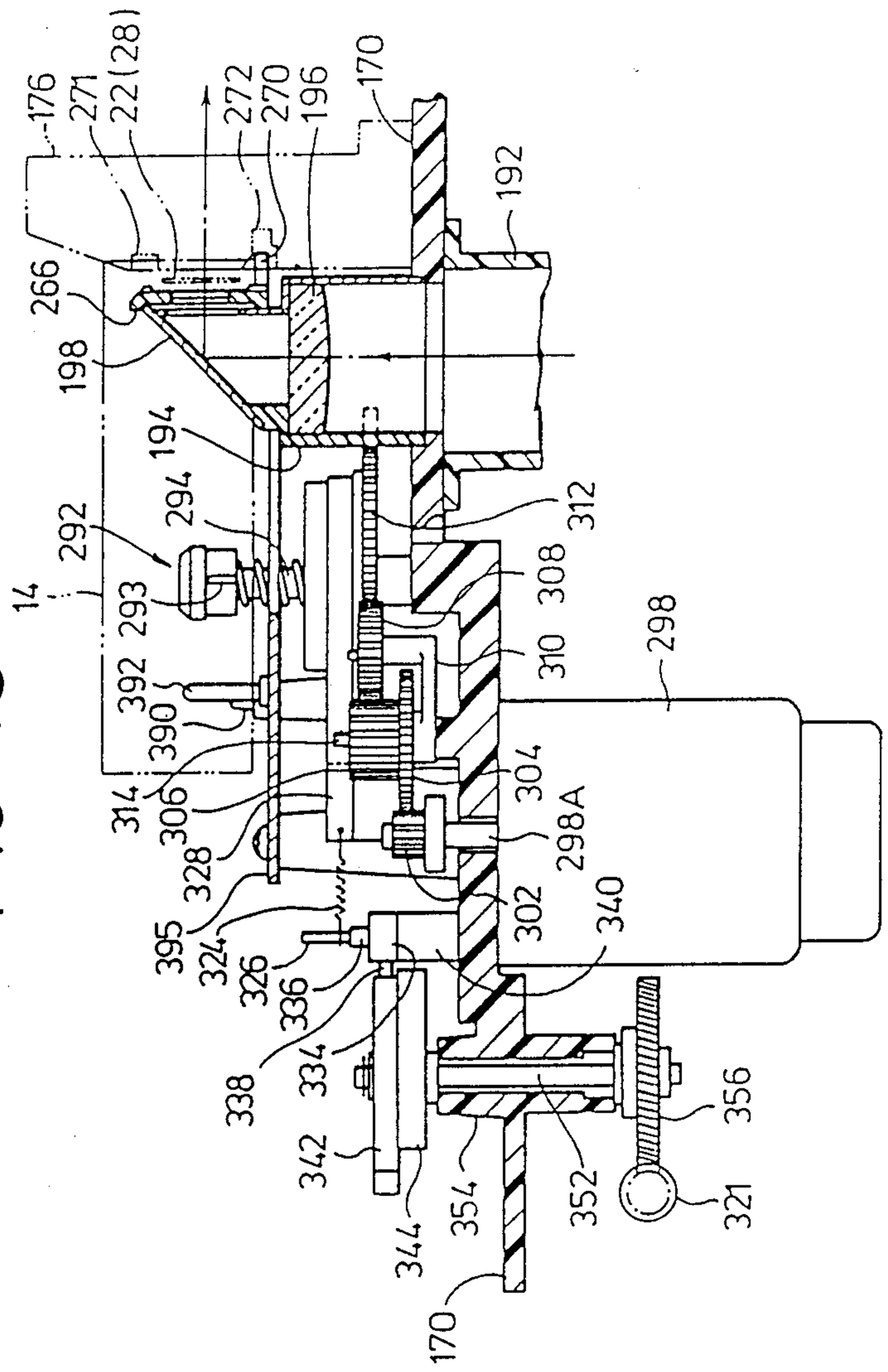
182
174

FIG-18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22(28)
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390
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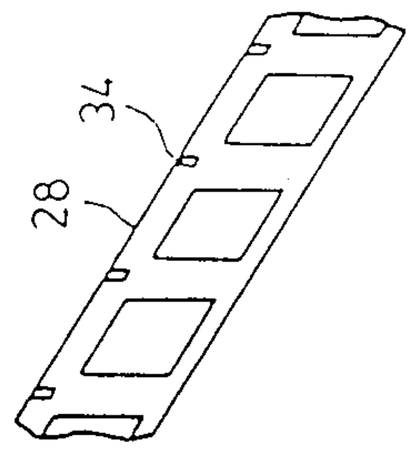
34
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FIG-19

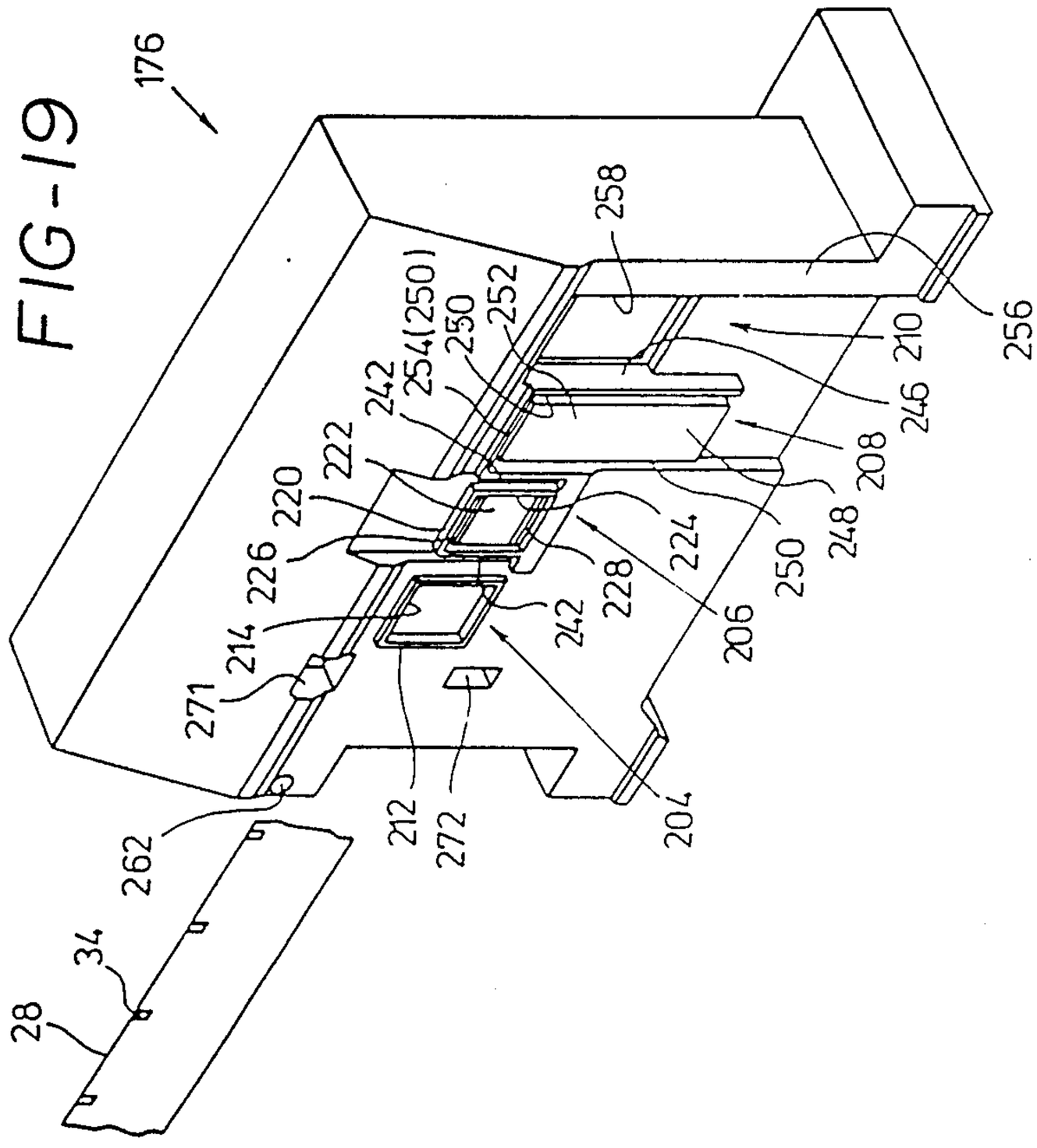
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FIG -20

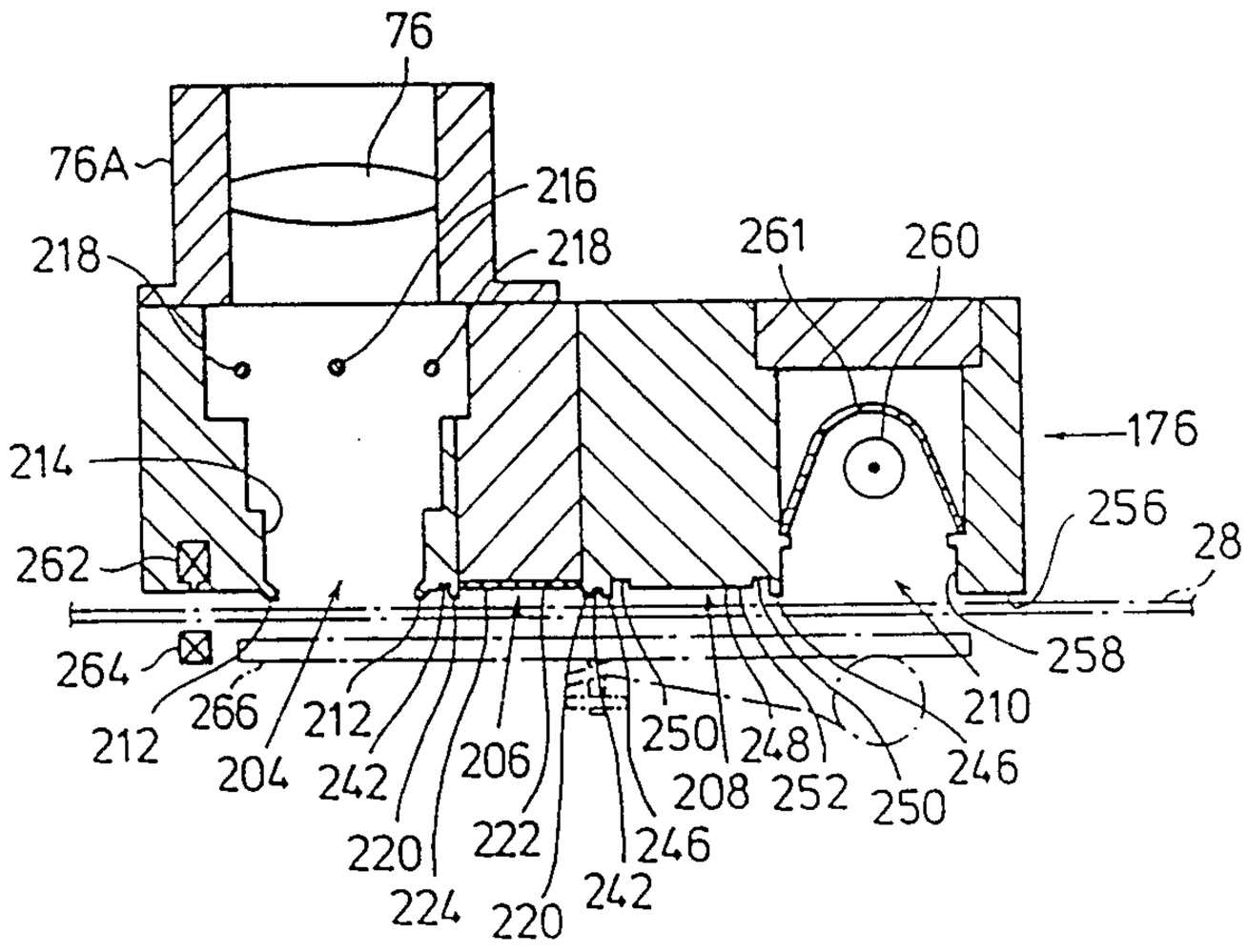
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FIG -21

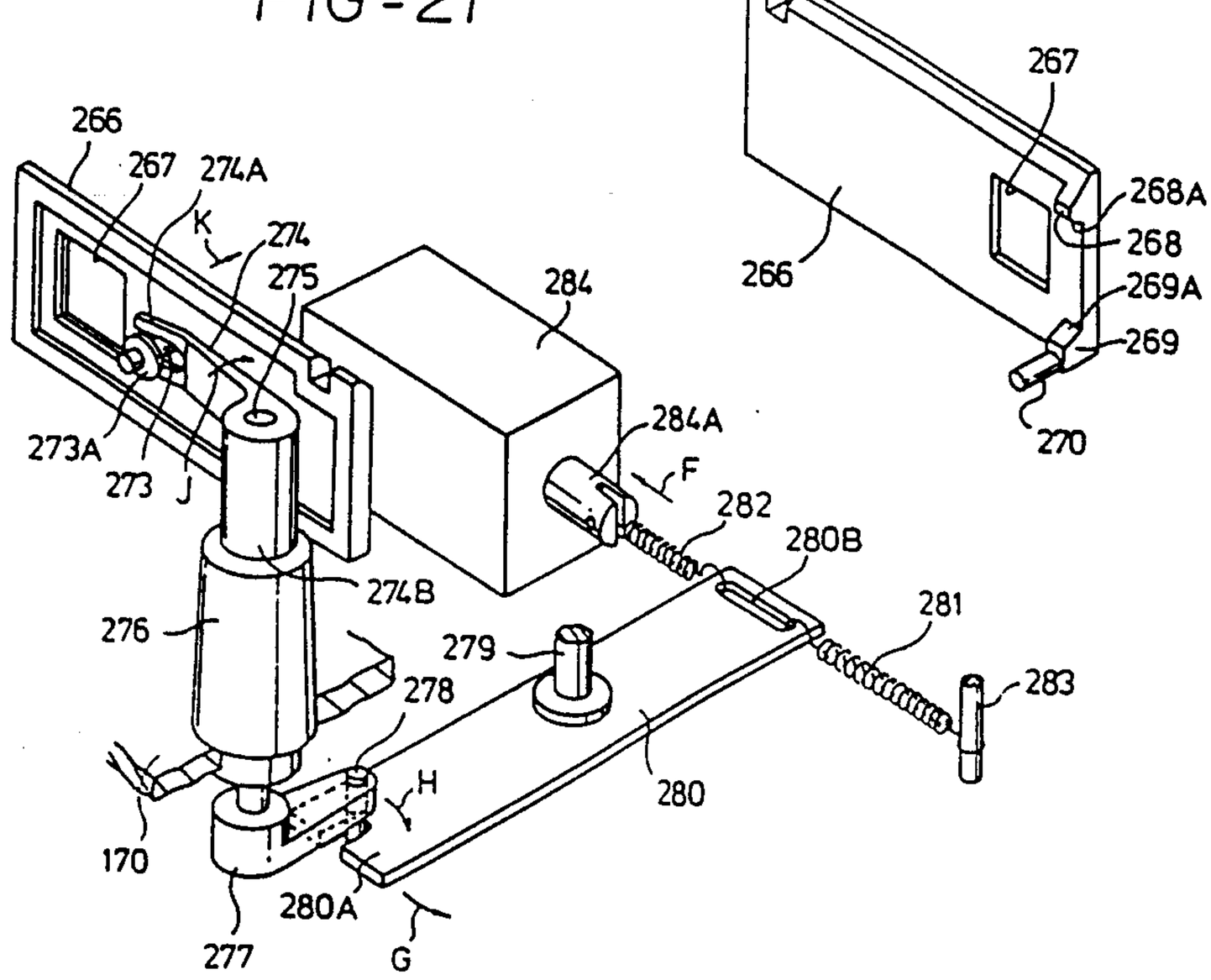
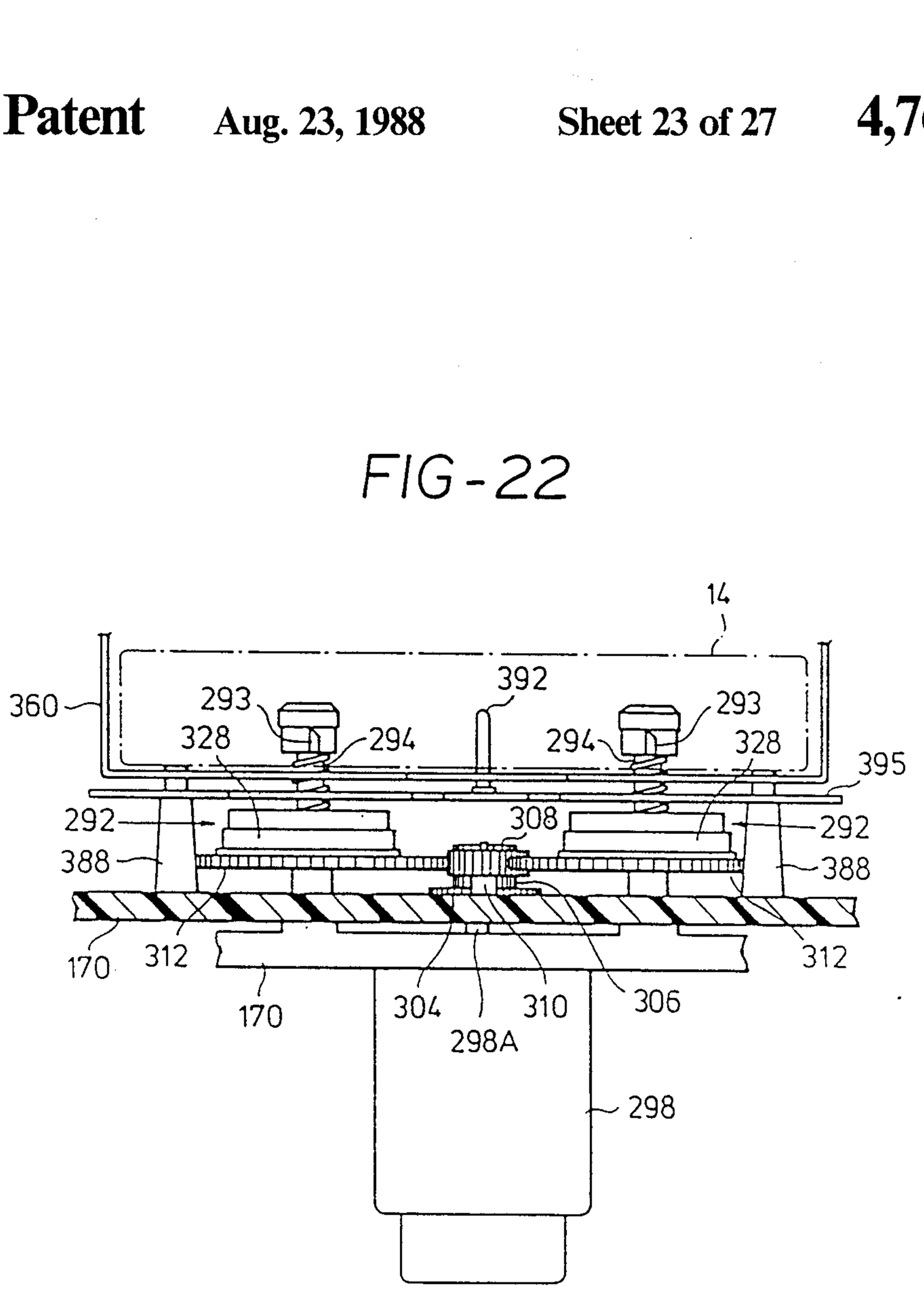


FIG -21A

FIG-22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298A
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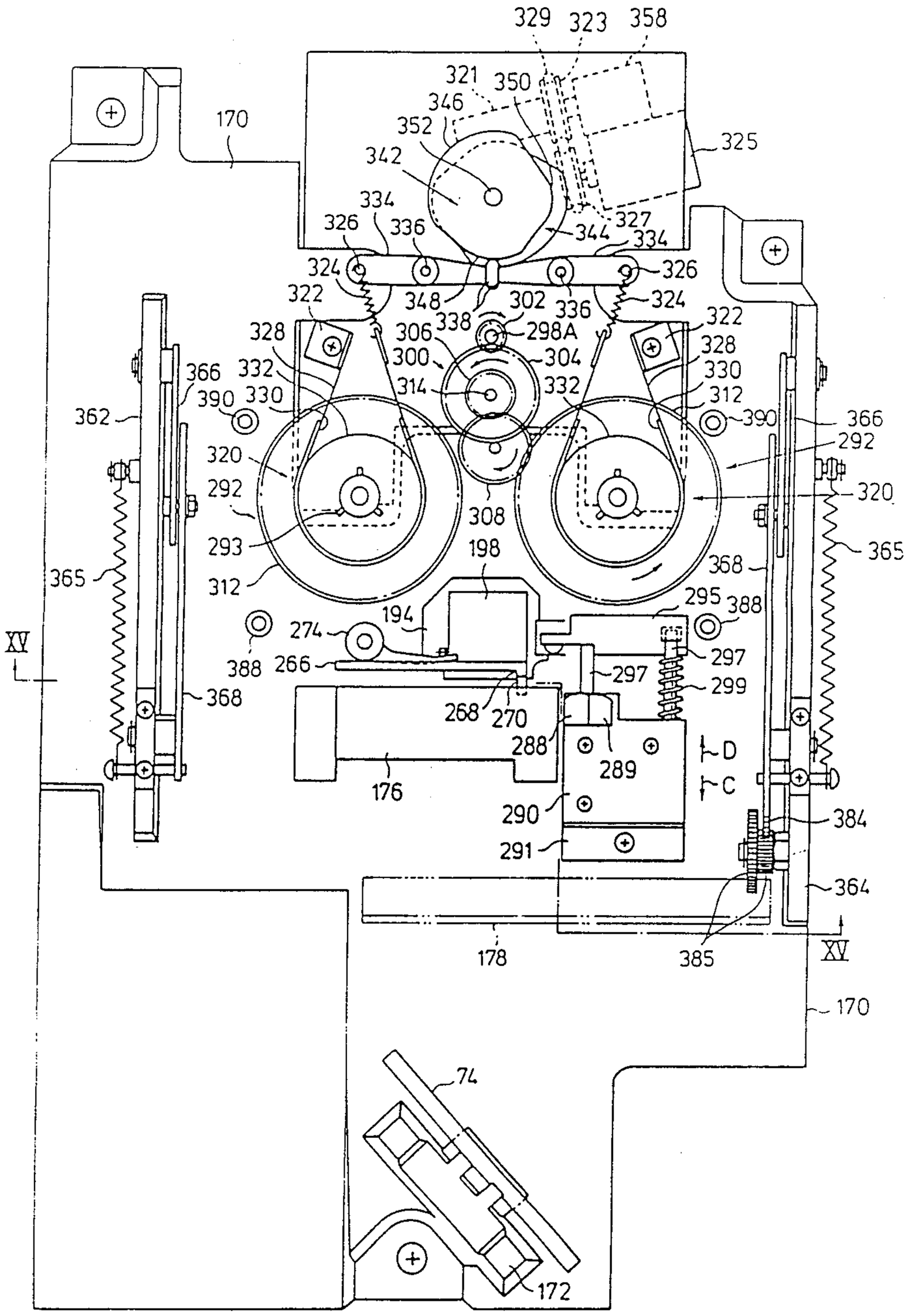
FIG-23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338
298A
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300
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297
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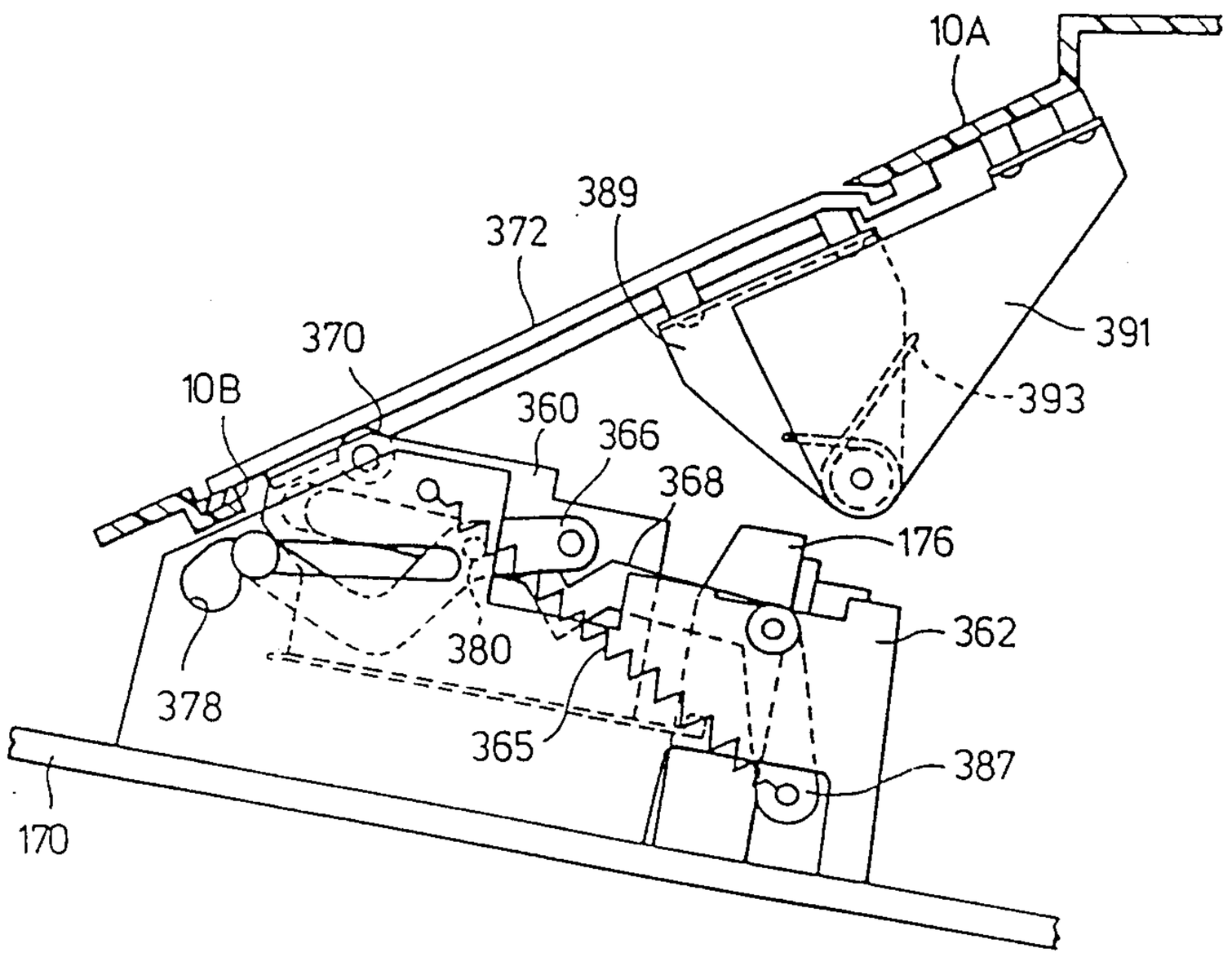
FIG - 24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170

FIG-24A

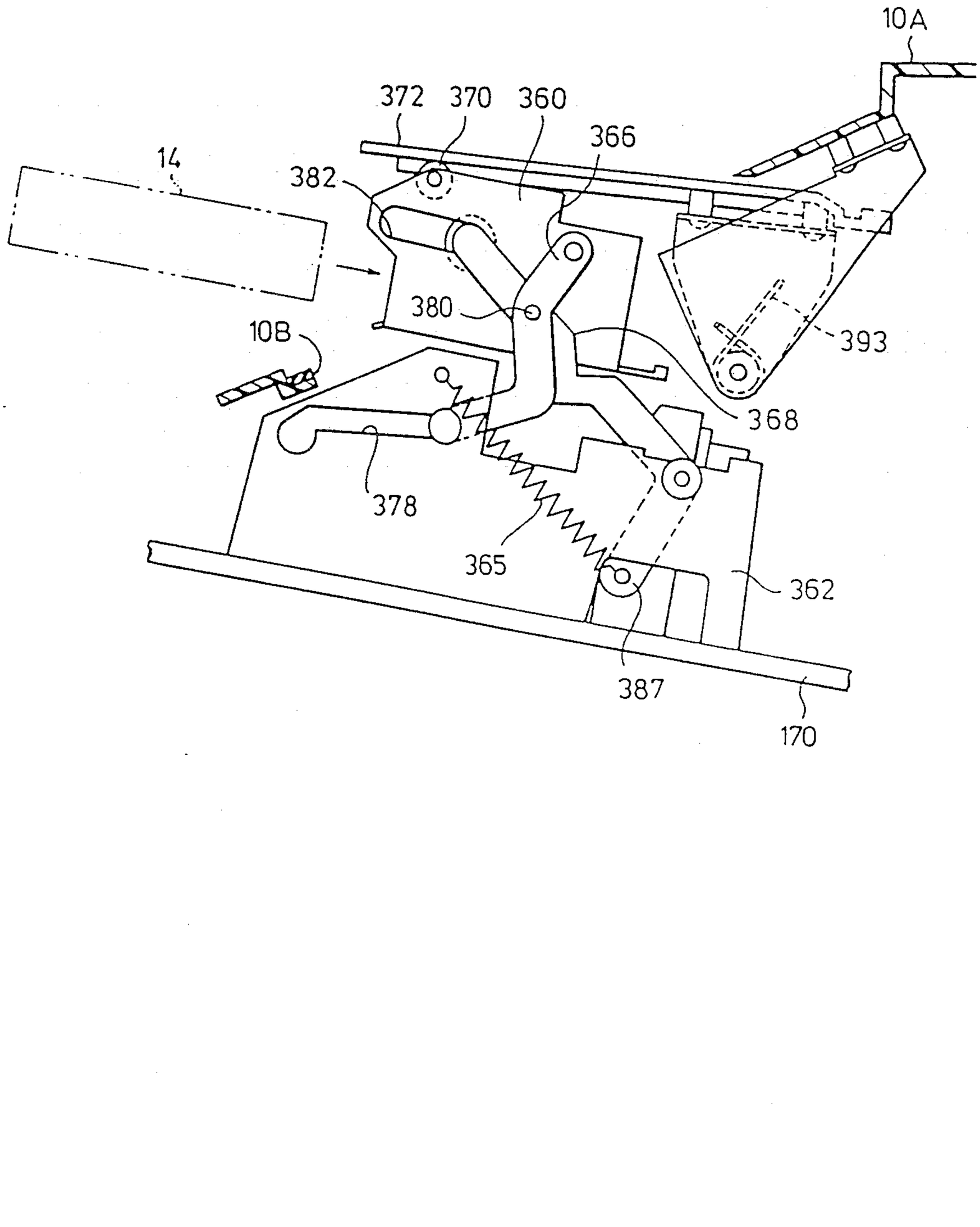
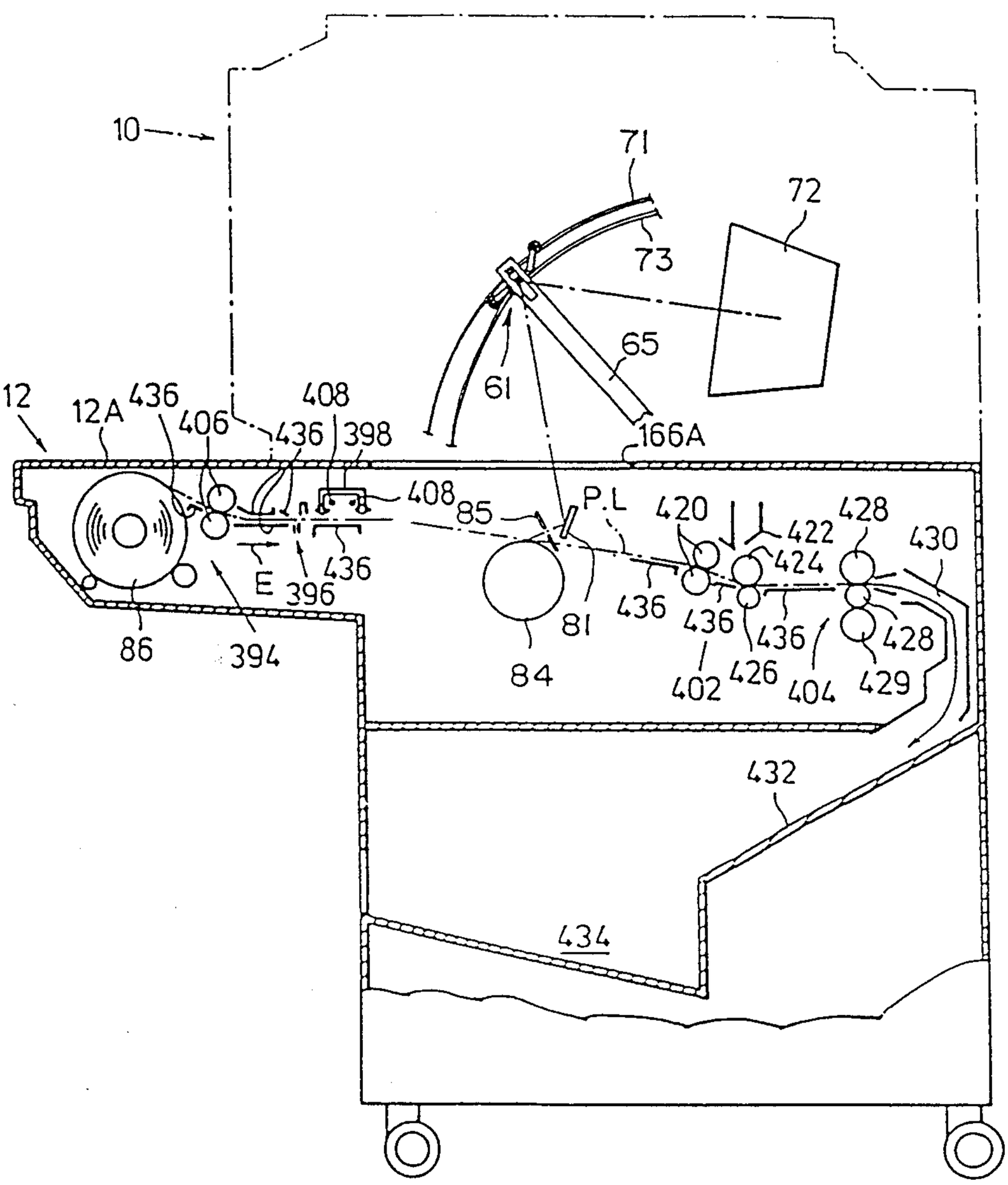


FIG-25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E
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436
436
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402
426
404
429
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APPARATUS FOR PROJECTING, RECORDING AND COPYING AN IMAGE IN AN ELECTROPHOTOGRAPHIC SYSTEM HAVING MECHANISMS FOR SIMULTANEOUSLY PROJECTING AND RECORDING THE SAME IMAGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a projecting, recording and copying apparatus for use in an electrophotographic system, and more particularly to a projecting, recording and copying apparatus for use in an electrophotographic system which is arranged to carry out formation of an image on a screen thereof, simultaneously with that of the same image on a photosensitive drum.

2. Description of the Related Art

Projecting and recording systems of the type that records an image on a predetermined frame of a photosensitive film such as a microfilm, and that is capable of projecting the thus-recorded image, have heretofore been proposed, for example, in U.S. Pat. Nos. 4,461,566 and 3,697,176.

Also, a reader printer for enlarging an image recorded on a film, and projecting the image on a screen or copying the image has been proposed in U.S. Pat. Nos. 3,811,769 and 3,907,418.

It has hitherto been known that two movable mirrors are employed in an apparatus of the type in which enlarged images of frames of microfilm are formed on a photosensitive drum by means of a conventional mirror scan.

In the conventional apparatus having three functions of recording a manuscript on a film as an image, projecting the image recorded and copying the same, however, it is difficult to ensure enough space for disposition of an optical system, and a long optical path length is needed to ensure enough space to enable the two movable mirrors to move, and this leads to the problem that a compact optical system cannot be realized.

SUMMARY OF THE INVENTION

In view of the above-described circumstances, it is an object of the present invention to provide a projecting, recording and copying apparatus for use in an electrophotographic system which enables projecting and copying to be effected at the same time, and yet which is provided with a compact optical system.

To this end, the present invention provides a projecting, recording and copying apparatus which, as shown in FIG. **1**, comprises an image forming optical system **3** for forming an image recorded on film **1** on a screen **2**; a movable mirror **4** of a narrow width disposed between the screen **2** and the image-forming optical system **3** in such a manner as to be capable of traveling in the direction of its width and swiveling about its longitudinal axis so as to reflect a portion of the light rays transmitted through the image forming optical system **3**; a drum **5** disposed for free rotation about its axis and having a photosensitive material on its surface; a mirror-moving device for causing movement of the movable mirror **4** so that, if l represents the length of a perpendicular drawn to the screen **2** from a principal point H of the image-forming optical system **3**, θ representing an angle formed by the perpendicular and a straight line connecting the principal point H and a center M of the movable mirror **4**, lsecθ is the sum of an optical path length x as between the principal point H and the center M of the movable mirror **4** and an optical path length y as between the center M of the movable mirror **4** and a center P of the surface of the drum **5**; a mirror swiveling device for causing the movable mirror **4** to swivel about its axis in such a manner that a normal N passing the center M of the movable mirror **4** normally passes the inner center of a triangle the vertexes of which are constituted by the center M of the movable mirror **4**, the center P of the surface of the drum **5** and the principal point H.

Further objects, features and advantages of the present invention will become apparent from the following description of a preferred embodiment of the present invention with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1** through **25** diagrammatically show one preferred embodiment of a projecting, recording and copying apparatus in accordance with the present invention, in which:

FIG. **1** is a diagram used with an aid to explaining the principle of the present invention;

FIG. **2** is a perspective view showing the external appearance of the projecting, recording and copying apparatus including a combination of a projecting and recording apparatus body and a copying machine;

FIG. **3** is a front elevational view of the external appearance of the projecting, recording and copying apparatus, the copying machine being shown by the imaginary line;

FIG. **4** is a perspective view of the external appearance of the cassette shown which is loaded into the apparatus in accordance with the presently preferred embodiment of the present invention;

FIG. **5** is a perspective view of the external appearance of the cassette shown in FIG. **4** as viewed from the reverse side thereof;

FIG. **6** is a perspective view of a tape and reels, which are accommodated by the cassette;

FIG. **7** is a detailed view of a portion of an electrophotographic film;

FIG. **8** is a sectional view of the electrophotographic film taken along the line VII—VII of FIG. **7**;

FIG. **9** is a schematic perspective view of a recording optical system in the projecting, recording and copying apparatus;

FIG. **10** is a schematic perspective view of a projecting optical system in the projecting, recording and copying apparatus;

FIG. **11** is a schematic perspective view of a copying optical system in the projecting, recording and copying apparatus;

FIG. **12A** is a diagram, showing respective guide rails for carrying a movable mirror according to the invention, so as to aid in the explanation of the formula of the curve along which respective guide rails are formed;

FIG. **12B** is an enlarged, schematic view of one longitudinal end of the movable mirror and associated elements according to the invention.

FIG. **12C** is another enlarged, schematic view similar to that of FIG. **12B**, but showing a modified form for the associated elements for causing the movable mirror according to the invention to travel in a swiveling manner.

FIG. **13** is a sectional view taken along the line XI—XI of FIG. **3** showing the internal structure of the projecting and recording apparatus body;

FIG. **14** is a plan view of the projecting and recording apparatus with a document pressing plate of a document table being removed, which corresponds to a sectional view taken along the line XII—XII of FIG. **5**;

FIG. **15** is a sectional view taken along the line XIII—XIII of FIG. **13**, showing the internal structure of the projecting and recording apparatus body;

FIG. **16** is a sectional view taken along the line XIV—XIV of FIG. **3**, showing the internal structure of the projecting and recording apparatus body;

FIG. **17** is a sectional view taken along the line XV—XV of each of FIGS. **16** and **23**, showing the internal structure of the projecting and recording apparatus body;

FIG. **18** is a sectional view taken along the line XVI—XVI of FIG. **17**, showing the internal structure of the projecting and recording apparatus body;

FIG. **19** is a perspective view of a processing head for carrying out each of the steps of processing an electrophotographic film;

FIG. **20** is a sectional view of the processing head of FIG. **19**, but taken along its horizontal line;

FIGS. **21** and **21A** are respectively perspective views showing a pressing head in detail;

FIG. **22** is a sectional view taken along the line XX—XX of FIG. **16**, showing the internal structure of the projecting and recording apparatus body;

FIG. **23** is a sectional view taken along the line XXI—XXI of FIG. **17**, showing the internal structure of the projecting and recording apparatus body;

FIG. **24** is a sectional view taken along the line XXII—XXII of FIG. **17**, showing the internal structure of the projecting and recording apparatus body;

FIG. **24A** is a sectional view, similar to FIG. **24**, taken along the line XXII—XXII of **5** FIG. **17**, but showing the state of operation of the internal structure of the projecting and recording apparatus body; and

FIG. **25** is a sectional view taken along the line XXIII—XXIII of FIG. **3**, diagrammatically showing the internal structure of the copying machine incorporated in the projecting and recording apparatus body.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. **1** to **25** respectively show a preferred embodiment of the projecting, recording and copying apparatus to which the present invention is applied.

The operation of the present invention will first be described below in brief with specific reference to FIG. **1**.

The image recorded on the film **1** is formed on the screen by an illuminating projection device disposed behind the film **1** and the image-forming optical system **3** disposed in front of the film **1**. Since the movable mirror **4** is disposed between the image forming optical system **3** and the screen **2**, a portion of the light rays directed toward the screen **2** by the image-forming optical system **3** is reflected by the reflection surface of the movable mirror **4**. At this time, if the movable mirror **4** is made to swivel about its longitudinal axis in such a manner that the normal N passing the center M of the movable mirror **4** normally passes the inner center of an imaginary triangle the vertexes of which consist of the principal point H of the image-forming optical system **3**, the center M of the movable mirror **4** and the center P of the surface of the drum **5**, the normal N consistently coincides with the direction of a bisector with respect to ∠ HMP. Accordingly, after the light rays have passed the principal point H and have been reflected from the center point M of the movable mirror **4**, the light rays normally passes the center P of the surface of the drum **5** even if the movable mirror **4** is moved in the direction of its width. In addition, since various abberations such as a spherical abberation are eliminated from the image-forming optical system **3**, a clear image is formed all over the surface of the screen **2**. Accordingly, if the movable mirror **4** is made to travel by means of the mirror moving device in such a manner that the sum x +y of the optical path length x as between the principal point H and the center M of the movable mirror **4** and the optical path length as between the center M of the movable mirror and the center P of the surface of the drum **5** coincides with the distance lsecθ of the straight line extending from the principal point H through the center M of the movable mirror **4** to the screen **2**, the reflected light rays can be applied to the point P in the previously-described manner, thereby forming a clear image on the point P by means of the reflected light rays.

As described above, in accordance with the present invention, as the movable mirror is made to swivel about its axis and travel transversely with respect to the pencil of light rays shone by the image-forming optical system. Accordingly, if the drum is rotated in synchronism with the speed of travel of the movable mirror, the image recorded on the film is formed on the screen and at the same time the same image as that formed on the screen can be recorded over a predetermined area of the surface of the drum in a photosensitive manner.

Therefore, in accordance with the present invention, as one visually inspects the image formed on the screen, he/she can record the same image on the photosensitive surface of the drum. In addition, since a single movable mirror is employed, a compact optical system can be realized.

FIG. **2** is a perspective view of the external appearance of the whole of the projecting, recording and copying apparatus, and FIG. **3** is a front elevational view of the apparatus shown in FIG. **2**. The projecting, recording and copying apparatus shown in FIG. **2** has an integral structure essentially constituted by a projecting and recording apparatus body **10** and a copying machine **12** having a housing **12A** serving also as a table for mounting the body **10**. It is to be noted that the projecting and recording apparatus body **10** may be used in the form of a separate unit as shown by the solid line in FIG. **3**.

The presently preferred embodiment of the invention will be described below in detail.

(Cassette)

FIGS. **4** and **5** show a cassette which is loaded in the projecting and recording apparatus. FIG. **4** is a perspective view of the external appearance of the cassette as viewed from the upper side thereof, and FIG. **5** is a perspective view of the cassette as viewed from the reverse side thereof.

A cassette **14** has a guard panel **18** disposed on the front side thereof. The guard panel **18** is pivotally supported at both longitudinal ends thereof by a cassette casing **16** so that the panel **18** is able to pivot in the direction of the arrow A. As shown in FIG. **4**, the cassette casing **16** has a recess **20** which opens in both the

front and reverse sides. The intermediate portion of a tape **22** which is accommodated inside the cassette casing **16** extends through the recess **20** in the lateral direction of the cassette casing **16**. A portion of the tape **22** which is positioned in the recess **20** is exposed at the front side of the cassette casing **16** when the guard panel **18** is pivoted in the direction of the arrow A.

Referring to FIG. **6**, the tape **22** is essentially constituted by a leader tape **24**, a magnetic tape **26** and an electrophotographic film **28**, which are spliced together along the longitudinal direction of the tape **22** by pieces of splicing tape **30**. Both end portions of the tape **22** are respectively retained by a pair of reels **32** which are accommodated by the cassette casing **16** so that the tape **22** is wound on the reels **32**.

As shown in FIG. **7**, the electrophotographic film **28** is printed with blip marks **34** along the upper edge thereof at predetermined regular spacings in the longitudinal direction of the film **28** (no blip marks **34** are shown in FIG. **6**). As will be clear from FIG. **8** (a sectional view taken along the line VII—VII of FIG. **7**), the electrophotographic film **28** includes a transparent base **36** (with a thickness of about 75 μm) made of, e.g., polyethylene, and an optically transparent, electrically conductive thin layer **38** formed on the base **36** by evaporation or other similar means. Furthermore, a photosensitive layer **42** (with a thickness of about 9 μm), which becomes electrically conductive when it receives light, is formed on the electrically conductive layer **38** with an intermediate layer **40** interposed therebetween. The photosensitive layer **42** is essentially constituted by a photoconductive layer **43** (with a thickness of about 8 μm) and a protective coat **44** (with a thickness of about 1 μm) for protecting the layer **43**. The electrophotographic film **28** is disposed in such a manner that, when the film **28** is positioned in the recess **20** defined in the cassette casing **16**, the side of the film **28** which is closer to the photoconductive layer **43** faces the guard panel **18**. It should be noted that the electrophotographic film shown in FIG. **7** is not necessarily limitative, and any known type of electrophotographic film may be employed.

As shown in FIG. **6**, a contact piece **48** is secured to a boss portion **46** of each reel **32**. The contact piece **48** provides electrical connection between the optically transparent, electrically conductive layer **38** of the electrophotographic film **28** and external contacts **50** (see FIG. **4**) exposed at the upper surface of the cassette casing **16**. As shown in FIG. **5**, each boss portion **46** the shape of a tube the bottom of which is opened, and projecting walls **52** are formed on the inner peripheral wall of the boss portion **46** at equal spacings. The boss portions **46** are respectively positioned in through-holes **54** provided in the bottom of the cassette casing **16** in such a manner that the boss portions **46** are exposed to the outside of the cassette casing **16**.

The bottom of the cassette casing **16** is, as shown in FIG. **5**, provided with a pair of positioning projections **56A** which come into contact with positioning pins, respectively, a pair of positioning holes **56B** each closed at one end thereof which receive positioning pins, respectively, and a through-hole **58** for receiving a brake releasing pin. When the pin is inserted into the through-hole **58**, a brake mechanism is released which engages with rectangular projections **62** formed on the outer periphery of a flange portion **60** of each of the reels **32** (see FIG. **6**) to prevent rotation of the reels **32**.

(Optical Systems in Projecting, Recording and Copying Apparatus)

FIGS. **9** to **11** schematically show various optical systems in the projecting, recording and copying apparatus, respectively.

Referring first to FIG. **9**, a recording optical system includes a document illuminating apparatus **68** according to the present invention which illuminates a document **66** as a subject which is set on a document table **64**, a third mirror **70** on which the light reflected from the document **66** is made incident, a second mirror **72** on which the light reflected from the third mirror **70** is made incident, a first mirror **74** on which the light reflected from the second mirror **72** is made incident, and a main lens **76** for focusing the light reflected from the first mirror **74** on the surface of the electrophotographic film **28**.

Referring next to FIG. **10**, a projecting optical system includes a projecting light source section **78** for illuminating the electrophotographic film **28**, the main lens **76** for focusing the light passing through the film **28** on the first mirror **74**, the second mirror **72** on which the light reflected from the first mirror **74** is made incident, and a screen **80** on which the light reflected from the second mirror **72** is projected.

As shown in FIG. **11**, a copying optical system includes, the projecting light source section **78**, the main lens **76**, the first mirror **74**, the second mirror **72**, a conversion lens **82** disposed between the main lens **76** and the first mirror **74** to slightly reduce the optical image formed on the first mirror **74**, a movable mirror **61** and a fixed mirror **8**, the light which has been reflected from the second mirror **72** being reflected from the mirrors **61** and **8** toward a sheet of copying paper **86** wound around a photosensitive drum **84** of a copying machine **12** (see FIGS. **1** and **2**). The fixed mirror **8** is provided for turning an image upside down, for example, in a transfer step such as the transfer of toner images performed in the process of forming an focused image into the final image. If the reversal of an image is not needed, the fixed mirror **8** may be omitted. The movable mirror **61** has rods **63** at its longitudinal ends, the rods **63** projecting longitudinally therefrom. Arms **65** are disposed adjacent to the longitudinal ends of the movable mirror **61**, slots **6** being respectively formed in the end portions of the arms **65** such that the rods **63** are inserted into the slits **6**. The arms **65** are connected to a swiveling device (not shown) for causing the arms **65** to swivel in the directions of the double-headed arrow Ar shown in FIG. **10**. First guide rails **71** and second guide rails **73** are disposed adjacent to the longitidunal ends of the movable mirror **61**. In addition, respective pairs of first rollers **75** and second rollers **77** are rotatably mounted on the longitudinal ends of the movable mirror **61**, the first guide rollers **75** being guided along the first guide rails **71** with the second guide rollers **77** guided along the second guide rails **73**. One end of the movable mirror **61** is normally biased toward the associated second guide rail **73** by a pair of tension springs **79** each having one end fixed to the arm **65**. A movable member **85** formed with a slit is disposed between the fixed mirror **81** and the drum **84** in such a manner as to be moved in the directions of the double-headed arrow Br shown in FIG. **11** in synchronism with the speed of travel of the movable mirror **6**.

Referring to FIG. **12A**, the aforesaid first guide rails **71** and the aforesaid second guide rails **73** are respec-

tively provided with curves which are selected so as to fulfill the following requirements. As shown in FIG. **12**A, if l represents the principal point of the optical system constituted by the main lens **76** and the conversion lens **82**, representing the length of the perpendicular drawn from the principal point H to the screen **80**, x representing the optical path length as between the principal point H and the center M of the movable mirror **61**, θ representing the angle formed by the aforesaid perpendicular and a straight line connecting the principal point H and the center M of the movable mirror **61**, P representing the center of the surface of the drum **84** and y representing the optical path length extending from the center M of the movable mirror **61** through the fixed mirror **81** to the center P of the surface of the drum **84**,

(1) $x + y = l\sec\theta$, and

(2) the normal N passing the center M of the movable mirror **61** nomrally passes the inner center of a triangle the vertexes of which are constituted by the principal point H, the center M of the movable mirror **61** and the center P of the surface of the drum **84**. It is to be noted that, although the first guide rails **71** serve as guide means for holding the movable mirror **64** at a position corresponding to the center M, if the requirement set forth in item (2) is fulfilled, this construction need not necessarily be employed.

Accordingly, when the movable mirror **61** is caused to travel in the directions of the double-headed arrow Ar shown in FIG. **11** by swiveling the arm **65**, the movable mirror **61** is moved along the guide rails **71** and **73**. Since the respective gaps between the associated guide rails **71** and **73** are progressively enlarged as shown, the light rays passing through the film **28** are applied to the point P of the drum **84**, thereby illuminating the drum **84** in the form of a strip parallel to the axis thereof. Since the optical path length between the principal point H and the screen **80** consistently equals the optical path length between the principal point H and the surface of the drum **84**, the image recorded on the film **28** is formed on the aforesaid strip-shaped portion of the drum **84**. In consequence, if the rotational speed of the drum **84** is controlled in synchronism with the speed of travel of the movable mirror **61**, the image recorded on the film **28** is copied all over the surface of a sheet of copying paper.

During this time, the angle θ changes with time and therefore, if the variation is represented by $\theta(t)$, the drum **84** is rotated at a speed required to fulfill $l\tan\theta(t) = R \cdot W \cdot T$; where R representing the radius of the drum **84**, W representing the angular velocity of the drum **84** and t representing the time. It should be noted that the rotational speed of the drum **84** could be controlled by known control means such as a pulse motor, a cam or the like.

FIG. **12**B is an enlarged, schematic view of one longitudinal end of the movable mirror **61** and its associated portion.

FIG. **12**C is a view similar to FIG. **12**B, but showing a modified form for causing the movable mirror **61** to travel in a swiveling manner. In this illustrated arrangement, the ends of the guide rails **71** and **73** are constituted by a pair of guide rails. The rods **63** are made to slide along the guide rails **73** while sliding members **61**A fixed to the movable mirror **61** is made to slide along the guide rails **71**. Therefore, the mirror **61** is capable of being moved about the straight line passing through the center M of the movable mirror **61**.

The main lens **76** and the first and second mirrors **74**, **72** are commonly used for the above-described three optical systems, and they are fixedly disposed within the housing **10**A of the projecting and recording apparatus body **10** (see FIGS. **2** and **3**). The third mirror **70**, the movable mirror **61**, the conversion lens **82** and the screen **80** are also disposed within the projecting and recording apparatus body **10** and selectively used. The third mirror **70**, the movable mirror **61** and the conversion lens **82** are movably disposed within the housing **10**A so that they are prevented from interfering with any other optical system, whereas the screen **80** is fixedly disposed at the front side of the housing **10**A since it does not interfere with other optical systems.

(Document Table)

As shown in FIGS. **2** and **3**, the document table **64** is disposed on the left upper side of the projecting and recording apparatus body **10**. Referring to FIG. **13** (a sectional view taken along the line XI—XI of FIG. **3**), the document table **64** includes a transparent glass plate **92** disposed in such a manner as to cover a relatively large upper opening **90** provided in the upper side of the housing **10**A of the projecting and recording apparatus body **10**, and a document pressing plate **96** which is disposed in such a manner as to cover the upper surface of the glass plate **92** and which is able to be opened in the direction of the arrow B by means of an opening and closing member **94**. The document pressing plate **96** is essentially constituted by a cover **98**, a cushioning member **100** made of a sponge material and bonded to the cover **98**, and a white pressing sheet **102** bonded to the cushioning member **100**.

The glass plate **92** is supported at the periphery of the reverse side thereof by a mounting bracket **106** which is rigidly secured to side frames **104** provided on a base frame **134** in such a manner as to extend upwardly in opposing relationship to each other. The inner surface of the bracket **106** is painted in white. It should be noted that the opening and closing member **94** is also rigidly secured to the mounting bracket **106**.

As shown in FIG. **14** (a sectional view taken along the line XII—XII of FIG. **3**, showing the apparatus with the document pressing plate **96** being removed), thin-walled frame plates **110** for clamping the aforesaid glass plate **92** together with the mounting bracket **106** are respectively disposed at the front and rear end portions of the upper side of the glass plate **92**. Document positioning marks **112** are provided on the frame plate **110** positioned at the front end. The inner side surfaces of the frame plates **110** are also painted in white.

Since the respective inner sides of the mounting bracket **106** and the frame plates **110** are painted in white, when the document **66** set on the document table **62** (see FIG. **9**) is recorded on the electrophotographic film **28**, the light reflected from the portions painted in white is applied to the peripheral portion of a frame of the film **28** which is subjected to recording, and the peripheral portion is thereby exposed to light. In consequence, since the peripheral portion is exposed to light in this manner, no black frame is produced when the frame formed with an image is developed. (Document Illuminating Assembly)

Referring FIGS. **13**, **14** and **15** (a sectional view taken along the line XIII—XIII of FIG. **13**), the document illuminating assembly **68** according to the present invention is disposed below the document table **64**. The document illuminating assembly **68** includes illuminat-

ing lamps **114**, reflecting plates **116** for reflecting the light emitted from the lamps **114**, and aperture masks **118** which are respectively formed in side frames **104** in order to allow the light from the lamps **114** to uniformly illuminate the document **66** (see FIG. **9**).

The respective illuminating lamps **114** have a tubular configuration and are disposed below and on both sides of the glass plate **92** in such a manner that the lamps **114** extend parallel to the glass plate **92** in the longitudinal direction thereof. Both end portions of each illuminating lamp **114** are respectively supported by brackets **120** which are rigidly secured to the corresponding side frames **104**. Each reflecting plate **16** is also supported by the corresponding one of the brackets **120** and extends in the longitudinal direction of the glass plate **92** in such a manner as to cover the upper and lower and outer side portions of the corresponding lamp **114** as shown in FIG. **15**. The light emitted from each illuminating lamp **114** is applied to the document **66** set on the upper surface of the glass plate **92** through the opening in the associated aperture mask **118**.

The respective aperture masks **118** are designed to prevent non-uniform illumination of the document **66** which might be attributed to the arrangement in which the third mirror **70** is slanted with respect to the document table **64** in face-to-face relationship with each other. More specifically, the lower edge of the opening in the mask **118** is slanted downward from the left-hand side toward the right-hand side as viewed in FIG. **13** so that the right- and left-hand portions (as viewed in FIG. **13**) of the aperture mask **118** have different heights.

For the same reason as in the case of the aperture mask **118**, reflection plates **116** located on the lower sides of the respective illuminating lamps **114** are, as shown in FIG. **14**, enlarged in width in a stepped manner so as to increase their reflecting areas from the lower side toward the upper side as viewed in FIG. **14** for the purpose of preventing lowering in the illuminance of the light reflected from the portion of the document **66** which faces the lower end portion of the third mirror **70**. The aforesaid configuration of the lower reflection plates **116** need not necessarily be limited to the step-like configuration, and it is a matter of course that they may, for example, be tapered.

To prevent lowering in illuminance at the central portion of the document **66** located at a position which is remote from both the illuminating lamps **114** (the central position between the right and left illuminating lamps **114** as viewed in FIG. **15**), the substantially central portion of the mounting bracket **106** is, as shown in FIG. **15**, extended further downwardly as compared with the other end portions of the same so that the bracket **106** functions as an auxiliary reflecting plate.

As shown in FIGS. **13** and **15**, a cooling fan **126** is disposed inside the housing **10A** of the projecting and recording apparatus body **10** in such a manner that both end portions of the fan **126** are respectively supported by the side frames **104** disposed in opposing relation to each other. The cooling fan **126** is provided for the purpose of cooling the illuminating lamps **114** which have heated up and the atmosphere inside the housing **10A** which has been raised in temperature by the lamps **114**. The cooling fan **126** is driven by a motor **128** secured to the reverse side of one of the side frames **104** as shown in FIG. **15** so as to discharge the warm air inside the housing **10A** through a louver **130** shown in FIG. **13**.

(Screen Mirror lens)

As shown in FIGS. **2** and **3**, the screen **80** is disposed at the left front side of the projecting and recording apparatus body **10** in such a manner that a line perpendicular to the surface of the screen **80** is inclined at an angle θ with respect to a base frame **134** of the body **10** as shown in FIG. **13**. The screen **80** is of the translucent type in which an image which is projected from the rear side of the screen **80** is viewed in the form of transmitted light from the front side, i.e., the outside of the screen **80**.

Referring to FIG. **14**, the third mirror **70** is defined by a trapezoidal plane mirror, and fixed to a mirror frame **13** as shown in FIGS. **13** and **14**. Brackets **138** are rigidly secured to both lateral edges, respectively, of the left-hand end portion (as viewed in FIG. **13**) of the mirror frame **136**. The brackets **138** are pivotally supported on the opposing side frames **104** by means of pins **139**, respectively. One end of a wire **140** is retained by the right-hand end (as viewed in FIG. **13**) of the mirror frame **136**, i.e, the free end thereof. The intermediate portion of the wire **140** is passed over a pulley **142** which is rotatably supported by one of the side frames **104**, and the other end of the wire **140** is retained by a take-up pulley **144**.

The take-up pulley **144** is, as shown in FIG. **15**, rigidly secured to one end portion of a shaft **146**. The shaft **146** is rotatably supported by a bracket **150** with a substantially hat-shaped cross-section which is rigidly secured to a first subbase frame **148**. A worm wheel **152** is rigidly secured to the intermediate portion of the shaft **146**. The worm wheel **152** is meshed with a worm **156** which is rigidly secured to the shaft of a motor **154** mounted on the bracket **150**. It should be noted that the first subbase frame **148** is rigidly secured at both ends thereof to the opposing side frames **104**, respectively, the frame **148** being positioned above the base frame **134**.

The third mirror **70** is pivoted together with the mirror frame **136** which is pivoted about the pins **139** in response to the movement of the wire **140** which is wound up and unwound from the take-up pulley **144**, between the lower-limit position shown by the solid line in FIG. **13** and the upper-limit position shown by the chain line in the same Figure. Lower and upper limit switches **158** and **160** are secured to one of the side frames **104**, the switches **158** and **160** being adapted to come into contact with the mirror from **136** at the lower and upper limit positions, respectively, of the third mirror **70**.

The base frame **134** is provided with a bottom opening **166**. The projecting and recording apparatus body **10** and the copying machine **12** (shown in FIGS. **2** and **3**) spatially communicate with each other through the bottom opening **166** and another opening **166A** (see FIG. **25**) provided in the copying machine **12**.

As shown in FIGS. **13** and **14**, the second mirror **72** is defined by a trapezoidal plane mirror and rigidly secured to the first subbase frame **148** through the intermediary of a bracket **168**. The second mirror **72** is inclined at an angle θ with respect to the base frame **134** in a manner similar to that of the screen **80** and at the same time, the second mirror **72** is, as shown in FIG. **14**, inclined at an angle of 45° with respect to the longitudinal axis of the projecting and recording apparatus body **10**.

As shown in FIGS. **14** and **16** (a sectional view taken along the line XIV—XIV in FIG. **3**), the first mirror **74** is similarly defined by a trapezoidal plane mirror and rigidly secured to a second subbase frame **170** (see FIG. **16**) through the intermediary of a bracket **172**. The first mirror **74** is inclined at an angle θ with respect to the base frame **134** and at the same time, the mirror **74** is inclined at an angle of 45° with respect to the longitudinal axis of the projecting and recording apparatus body **10** as shown in FIG. **14** in a manner similar to that of the second mirror **72**. The second subbase frame **170** is, as shown in FIG. **14**, rigidly secured to the base frame **134** by stays **174** in the state of being inclined at an angle θ with respect to the base frame **134**.

As shown in FIG. **16**, the main lens **76** is incorporated in a lens barrel **76A** and rigidly secured to the second subbase frame **170** together with a processing head **176** in one unit. The main lens **76** is disposed in such a manner that the optical axis thereof is inclined at an angle θ with respect to the base frame **134**.

The conversion lens **82** is, as shown in FIG. **16**, disposed between the first mirror **74** and the main lens **76**, and adapted to be movable by a moving mechanism (not shown) between two positions, that is, a position at which the optical axis thereof is coincident with that of the main lens **76** and a position at which the lens **82** does not interfere with the lens **76**.

As shown in FIG. **16**, a bulkhead **178** is provided on the second subbase frame **170** in such a manner as to extend in a direction perpendicular to the frame **170**, and a shutter **180** is disposed on the bulkhead **178** so that it is possible to shut the optical path defined between the main lens **76** and the first mirror **74**. The shutter **180** is connected to an automatic exposure controller (not shown).

(Projecting Light Source Section)

Referring to FIGS. **16** and **17** (a sectional view taken along the line XV—XV of FIGS. **16** and **23** which is described later), a lamp box **182** is disposed in the projecting light source section **78**. The lamp box **182** is, as shown in FIG. **17**, provided with a halogen lamp **184** which defines a light source, a reflecting plate **186** disposed at the rear side of the halogen lamp **184**, condenser lenses **188** for condensing the light emitted from the halogen lamp **184**, and a lower projecting mirror **190** adapted to reflect the light from the halogen lamp **184** at a right angle so that the light is projected upward.

It should be noted that a part of the lamp box **182** defines a part of a side wall of the housing **10A** of the projecting and recording apparatus body **10** as shown in FIGS. **2** and **17** so that the lamp box **182** can be readily removed from the body **10** when, for example, the lamp **184** is replaced with a new one.

The projecting light source section **78** is essentially constituted by the lamp box **182**, a tubular member **192**, a tubular member **194** (see FIG. **15**), and a condenser lens **196** as well as an upper projecting mirror **198** respectively supported by the intermediate and upper portions of the tubular member **194** as shown in FIG. **18** (a sectional view taken along the line XVI—XVI of FIG. **17**). The tubular member **192** is suspended from the second subbase frame **170** in such a manner that the tubular member **192** extends between the frame **170** and the lamp box **182** to prevent scattering of the light from the halogen lamp **184** which passes through the inside of the tubular member **192**.

The tubular member **194** is provided on the second subbase frame **170** in such a manner as to project upward therefrom. The inside of the tubular member **194** communicates with that of the tubular member **192**, and an opening is provided in the upper part of the tubular member **194** so as to face the processing head **177** as shown in FIG. **18**. Thus, the light from the halogen lamp **184** is first reflected by the lower projecting mirror **190** and condensed by the condenser lens **196** so as to be incident on the upper projecting mirror **198** from the lower side thereof, and the upper projecting mirror **198** reflects the light at a right angle so that the reflected light is projected toward the processing head **176**.

As shown in FIG. **16**, a cooling fan **200** is rigidly secured to the base frame **134** adjacent to the lamp box **182**. The fan **200** is provided for the purpose of cooling the halogen lamp **184** which has heated up and the atmosphere within the housing **10A** which has been raised in temperature by the halogen lamp **184**. The warm air inside the housing **10A** is discharged from the louver **202** shown in FIG. **1**.

(Processing Head)

Referring to FIGS. **16** and **18**, the processing head **176** is rigidly secured to the second subbase frame **170** in such a manner that the processing head **176** is disposed adjacent to the tubular member **194** as shown in FIG. **18**. The processing head **176** is, as shown in FIGS. **19** and **20**, provided with a charging exposure section **204**, a developing section **206**, a drying section **208** and a fixing section **210**.

The charging exposure section **204** has a projecting frame **212** which is adapted to contact the edge portion of each frame of the electrophotographic film **28**. A charging exposure chamber **214** is provided on the inner side of the projecting frame **212**, the chamber **214** being defined by a space which extends horizontally (in the vertical direction as viewed in FIG. **20**). In the charging exposure chamber **214** are disposed a corona wire **216** which extends vertically (in the direction perpendicular to the plane along which FIG. **18** is taken) and corona electrodes **218** disposed on both sides, respectively, of the corona wire **216**. The main lens **76** is mounted on the processing head **176** through the intermediary of the lens barrel **76A** on the opposite side to that on which the projecting frame **212** is formed. It should be noted that the optical axis of the main lens **76** is coincident with the center of the projecting frame **212**. The charging exposure chamber **214** faces the upper projecting mirror **198** supported by the tubular member **194** as shown in FIG. **18**.

The developing section **206** has a projecting frame **220**. The width of the opening defined by the projecting frame **220** is set so as to become slightly smaller than that of the opening defined by the projecting frame **212**. A developing electrode **222** which is formed from a metal sheet is disposed within the opening defined by the projecting frame **220**. The developing electrode **222** is positioned in such a manner that the outer surface thereof is located at a position which is slightly inwardly of the end face of the projecting frame **220**. The space surrounded by the projecting frame **220** and the developing electrode **222** defines a developing chamber **224**. An opening is provided between the upper edge of the electrode **222** and the projecting frame **220** to define a developer inlet **226**, and another opening is provided between the lower edge of the electrode **222** and the projecting frame **220** to define a developer outlet **228**,

the developer inlet and outlet **226**, **228** having a width equal to that of the electrode **222**.

The developer inlet **226** communicates with a developer tank **232** through a solenoid valve **230** shown in FIG. **16**. The developer tank **232** communicates with a developer bottle **238** in which a developer is stored by means of a pump **236** driven by a motor **234**. The developer is formed by dispersing finely divided toner particles in a solvent. A charging regulator is mixed with the developer so that the toner particles can be readily charged negative. The developer outlet **228** communicates with the developer bottle **238**. Air which is pumped from a pressure squeezing pump **240** is discharged from the developer inlet **226**.

Recesses **242** are respectively provided in the right and left sides of the projecting frames **220**. An opening is provided in a part of each of the recesses **242**, communicating with a suction squeezing pump **244**. It should be noted that pipes for connecting various devices or members are not shown in FIG. **16**.

The drying section **208** has a projecting frame **246**. The projecting frame **246** is essentially constituted by an upper frame member and right and left frame members and has no lower frame member. The width of the opening defined by the projecting frame **246** is set so as to become larger than that of the opening defined by the projecting frame **212**. A wall **248** is formed inside the projecting frame **246** in such a manner that the surface of the wall **248** is located at a position which is slightly inwardly of the end face of the projecting frame **246**. Recesses **250** are defined between the wall **248** and the projecting frame **246**. The space surrounded by the projecting frame **246**, the wall **248** and the recesses **250** defines a drying chamber **252**. An opening is provided in the recess **250** which is located at the upper part of the wall **248** so as to provide a warm air outlet **254**.

The fixing section **210** is defined between the right frame member (as viewed in FIG. **19**) of the projecting frame **246** and a projecting wall **256** which defines the right-hand end portion of the processing head **176**. The space in the fixing section **210** defines a fixing chamber **258**. In the fixing chamber **258** are disposed a xenon lamp **260** and a reflecting plate **261** for reflecting the light emitted from the lamp **260**. The width of the opening in the fixing chamber **258** is set so as to be larger than that of the opening in the drying chamber **252**.

The respective end faces of the projecting frames **212**, **220** and **246** are flush with each other. In addition, the charging exposure chamber **214**, the developing chamber **224**, the drying chamber **252** and the fixing chamber **258** are arranged so that consecutive frames of the electrophotographic film **28** are able to face these chambers, respectively, at the same time.

The processing head **176** has a blip sensor **262** which is disposed at a position on the left-hand end portion thereof (as viewed in FIG. **19**) which is slightly above the upper end of the projecting frame **212** of the charging exposure section **204**. The blip sensor **262** is defined by a light-receiving element and faces a sensor light source **264** disposed on a side pillar **263** which is integral with the tubular member **194** (see FIG. **17**).

As shown in FIG. **20**, a pressing plate **266** is disposed in front of the processing head **176**. The pressing plate **266** is, as shown in FIG. **21**, provided with a rectangular through-hole **267** which is a size smaller than the opening defined by the projecting frame **212** formed in the charging exposure section **204**. The pressing plate **266** is disposed in such a manner that the through-hole **267** opposes the projecting frame **212**.

As will be clear from FIG. **21**A (a perspective view of the pressing plate **266** shown in FIG. **21**, as viewed from the opposite side), the pressing plate **266** has fitting members **268** and **269** respectively formed on the upper and lower end portions on the side of the plate **266** which is closer to the through-hole **267**, the fitting members **268** and **269** projecting toward the processing head **176**. The opposing inner surfaces of the fitting members **268** and **269** are slanted as shown by the reference numerals **268**A and **269**A. As shown in FIG. **18**, the distance between the respective root portions of the upper and lower fitting members **268** and **269** is set so as to be equal to the width of the electrophotographic film **28** (strictly speaking, the aforesaid distance being slightly larger than the width of the film **28**) for the purpose of accurately determining the heightwise position of the electrophotographic film **28**. A columnar portion **270** projects from the distal end of the fitting member **269**. The fitting members **268** and **269** are able to be fitted into bores **271** and **272**, respectively, formed in the processing head **176**, as shown in FIG. **19**.

The pressing plate **266** has a columnar portion **273** projecting from the reverse surface thereof, that is, the surface thereof which is remote from the processing head **176**. This columnar portion **273** is engaged with a notched portion **274**A formed at one end portion of an arm **274**. A stop ring **273**A is rigidly secured to the distal end portion of the columnar portion **273** so as to prevent the arm **274** from coming off the columnar portion **273**. A boss portion **274**B is formed at the other end of the arm **274**. A shaft **275** is rigidly secured to the boss portion **274**B.

The shaft **275** is rotatably fitted into and thereby supported by a stand **276** projecting from the second subbase frame **170** to which the processing head **176** is secured, the lower end portion of the shaft **275** projecting from the reverse surface of the frame **170**. A first lever **277** is rigidly secured to the projecting lower end portion of the shaft **275**. A pin **278** is rigidly secured to the distal end portion of the first lever **277**.

A shaft **297** is suspended from the reverse side of the second subbase frame **170**. The shaft **279** pivotally supports the intermediate portion of a second lever **280**. A notched portion **280**A is formed at one end of the second lever **280**, and the pin **278** is engaged with the notched portion **280**A. A slot **280**B is formed in the other end portion of the second lever **280**, and one end portion of each of the tension coil springs **281** and **282** is retained by the slot **280**B, the springs **281** and **282** biasing the second lever **280** in the opposite directions to each other so as to resiliently support the lever **280**.

The other end portion of the tension coil spring **281** is retained by a pin **283** suspended from the reverse side of the second subbase frame **170**, while the other end portion of the tension coil spring **282** is retained by a plunger **284**A of a pull-type solenoid **284** which is secured to the reverse side of the frame **170**.

When the solenoid **284** is not energized, the pressing plate **266** is separated from the processing head **176**. In this state, the pressing plate **266** is supported in such a manner that the columnar portion **270** is fitted into the bore **272** formed in the processing head **176** as shown in FIG. **18**. (Magnetic Head)

Referring to FIG. **23** (a sectional view taken along the line XXI—XXI of FIG. **17**), a recording and repro-

ducing magnetic head **288** and an erasing magnetic head **289** for the magnetic tape **26** are disposed adjacent to the processing head **176**. The magnetic heads **288** and **289** are secured to a bracket **290** which, in turn, is mounted on a base **291** rigidly secured to the second subbase frame **170**. The bracket **290** is adapted to be movable along a shaft **297** which is supported by the second subbase frame **170** through the intermediary of a member **295**.

The bracket **290** is biased in the direction of the arrow C by means of a compression coil spring **299** wound on the shaft **297**. However, when a solenoid **301**, which is rigidly secured to the reverse side of the second subbase frame **170** as shown in FIG. **17**, is energized, the bracket **290** is moved in the direction of the arrow D against the biasing force of the spring **299**. The recording and reproducing magnetic head **288** and the erasing magnetic head **289** are positioned at the same level as that of the charging exposure chamber **214** and other chambers.

(Tape Driving Section)

Referring to FIG. **22** (a sectional view taken along the line XX—XX of FIG. **16**) and FIG. **23**, a pair of reel tables **292** are disposed on the second subbase frame **170**. Reel engaging projections **293** project radially from the top of each reel table **292**. Each reel table **292** is rotatably supported by the second subbase frame **170** through a pin **294**. Both the reel tables **292** can be rotated by a motor **298** (see FIG. **22**) disposed on the reverse side of the second subbase frame **170** through a driving force transmission mechanism **300**.

As shown in FIGS. **18** and **23**, the transmission mechanism **300** is essentially constituted by a gear **302** rigidly secured to a shaft **298**A of the motor **298**, a first intermediate gear **304**, a second intermediate gear **306**, a third intermediate gear **308**, an oscillating plate **310**, and gears **312** which are defined by the respective lower disk portions of the reel tables **292**.

The first and second intermediate gears **304** and **306** are coaxially connected together in one unit and rotatably supported by a pin **314** which projects upward from the second subbase frame **170**. The oscillating plate **310** is interposed between the second subbase frame **170** and the first intermediate gear **304** and pivotally supported by the pin **314**. The third intermediate gear **308** is rotatably supported by the oscillating plate **310**.

The gear **302** is meshed with the first intermediate gear **304**, and the second intermediate gear **306** is meshed with the third intermediate gear **308** which, in turn, is meshed with either one of the gears **312** on the reel tables **292** in accordance with the direction of rotation of the motor **298**.

As shown in FIG. **23**, a band brake **320** for applying back tension to the tape **22** is disposed on each of the reel tables **292**. The band brake **320** has a steel sheet band **328** retained at one end thereof by the second subbase frame **170** through a retainer piece **322**, the other end of the band **328** being retained by a pin **326** through a tension coil spring **324**. A felt brake shoe **330** is bonded to the band **328**. The brake shoe **330** is tightly wound on a cylindrical portion **332** of the reel table **292** under pressure by means of the tensile force applied from the tension coil spring **324**.

The pin **326** projects upward from one end of an arm **334**. The intermediate portion of the arm **334** is pivotally supported by a pin **336** projecting upward from the second subbase frame **170**. An abutment piece **338** is formed at the other end of the arm **334**. The band brakes **320** are respectively disposed on the pair of right and left reel tables **292** in symmetry with each other. As shown in FIG. **18**, each arm **334** has a collar **340** which is fitted on the associated pin **336** to separate the arm **334** from the surface of the second subbase frame **170**. Since the respective collars **340** of th two arms **334** have different heights, the arms **334** are disposed at different levels, so that their respective abutment pieces **338** overlap each other without any interference.

The abutment pieces **338** positioned in overlapping relation to each other are in pressure contact with cam plates **342** and **344**, respectively. Each of the cam plates **342** and **344** has a large-diameter portion **346**, an intermediate-diameter portion **348** and a small-diameter portion **350**. The two cam plates **342** and **344** have the same configuration and are rigidly secured to a shaft **352** in such a manner that one of them is turned upside down and made out of phase with the other. The shaft **352** is received and thereby rotatably supported by a bearing portion **354** formed on the second subbase frame **170**, the lower end portion of the shaft **352** projecting from the reverse side of the frame **170**.

A worm wheel **356** is rigidly secured to the lower end portion of the shaft **352**. The worm wheel **356** is meshed with a worm **321** which is rotatably supported in a cantilever fashion overhanding manner by a bearing member **358** secured to the reverse side of the second subbase frame **170**. A pulley **323** is rigidly secured to a shaft which supports the worm **321**. The pulley **323** is connected through a transmission belt **329** to a pulley **327** which is rigidly secured to the shaft of a motor **325** mounted on the reverse side of the second subbase frame **170**.

(Cassette Loading Section)

Referring to FIGS. **17** and **24** (a sectional view taken along the line XXII—XXII of FIG. **17**), the cassette loading section has a cassette holder **360** for holding the cassette **14**, cassette holder brackets **362**, **364** which project upward from the second subbase frame **170** to support the cassette holder **360**, and a pair of first arms **366** and a pair of second arms **368**, which connect the cassette holder **360** and the cassette holder brackets **362** and **364**.

Retaining members **374** made from metal leaf springs and adapted to resiliently retain the cassette **14** are secured to the right and left end portions, respectively, of the cassette holder **360**. Two retainer members **374** are provided on one of the aforesaid right and left end portions in series relation to each other, and these retainer members **374** serve also as contact pieces which are brought into pressure contact with the external contacts **50** provided on the cassette **14**. In addition, rollers **370** are rotatably disposed on the cassette holder **360**. The cassette holder brackets **362** and **364** are respectively positioned on both outer sides of the pair of reel tables **292**. As shown in FIG. **24**, one end portion of each of the first arms **366** is movably supported by a slot **378** provided in the corresponding cassette holder bracket **362** or **364**, and one end portion of each of the second arms **368** is pivotally supported by the bracket **362** or **364**.

The corresponding first and second arms **366** and **368** are disposed in such a manner as to intersect each other, and pivotally connected together at the intersection by means of a pin **380**. The other end portion of each of the

first arms **366** is pivotally connected to the cassette holder **360**. The other end portion of each of the second arms **368** is movably supported by a slot **382** provided in the cassette holder **360**, as shown in FIG. **24**A.

A sector gear **384** is, as shown in FIG. **23**, formed on one end portion of one of the second arms **368** on the side thereof which is closer to the position at which the aforesaid arm **368** is pivotally connected to the associated cassette holder bracket **364**. The sector gear **384** is meshed with a gear **385** which, in turn, is meshed with a rotary damper **386** as shown in FIG. **17**. Both the gear **385** and the rotary damper **386** are secured to the cassette holder bracket **364**.

In addition, each of the second arms **368** has a lever **387** extending from one end portion thereof which is closer to the position at which the arm **368** is pivotally connected to the corresponding cassette holder bracket **362** or **364**. One end of a tension coil spring **365** is retained by the lever **387**. The other end of the spring **365** is retained by the cassette holder bracket **362** or **364**. Thus, each of the second arms **368** is biased so as to pivot clockwise as viewed in FIG. **24** about the position at which the arm **368** is pivotally connected to the corresponding cassette holder bracket **362** or **364**, but the arm **368** is locked in the position shown in FIG. **24** by virtue of a stopper mechanism (not shown).

An opening **10B** is provided in that portion of the housing **10A** of the projecting and recording apparatus body **10** which is positioned above the cassette holder **360**, and a cover **372** is disposed at the opening **10B**. The cover **372** is pivotally mounted on the housing **10A** through the intermediary of brackets **389** and **391** which are pivotally connected to each other. The cover **372** is biased counterclockwise as viewed in FIG. **24** by means of a torsion coil spring **393**, and normally covers the opening **10B** as shown in FIG. **24**. In this state, the rollers **370** are in contact with the reverse side of the cover **372**.

As shown in FIG. **23**, two pairs of cassette positioning pins **388** and **390** are provided on the second subbase frame **170** in such a manner as to project upward around the reel tables **292**. The top surfaces of the cassette positioning pins **388** abut against the positioning projections **56**A, respectively, which are formed on the reverse surface of the cassette casing **16**, thereby effecting positioning of the cassette **14** in the heightwise direction thereof, and the cassette positioning pins **390** are respectively fitted into the positioning holes **56**B to effect positioning of the cassette **14** in the lateral direction thereof (in the direction which intersects both the pair of reel tables **292**).

In addition, a cover **395** covers the reel tables **292** and the gears and other members of the transmission mechanism **300**, and a brake release pin **392** which releases the brake mechanism of the cassette **14** is provided on the cover **395** so as to project therefrom upwardly.

(Copying Machine)

Referring to FIG. **25** (a sectional view taken along the line XXIII—XXIII in FIG. **3**), the copying machine **12** has a paper feed section **394** in which a copying paper **86** (CPC paper) in the shape of a roll is disposed, a cutter **396** for cutting the copying paper **86** into sheets, a charging device **398** for charging each sheet of copying paper **86** cut by the cutter **396**, the exposing drum **84** for supporting the charged sheet of copying paper **86** at an exposing position, a developing device **402** for developing the exposed sheet of copying paper **86**, and a fixing device for fixing the developed sheet of copying paper **86**.

A pair of feed rollers **406** are disposed in the paper feed section **394** to unwind the copying paper **86** in the shape of a roll and transport the paper **86** in the direction of the arrow E. A clutch (not shown) is associated with the feed rollers **406**. Corona wires **408** for effecting corona discharge are disposed in the charging device **398**. The exposing drum **84** is disposed below the aforesaid fixed mirror **81**,,and the copying paper **86** thus transported is wound around the drum **84**.

The developing device **402** has a pair of feed rollers **420**, a toner tank **422** storing toner, a toner roller **424** having the peripheral surface to which is attached the toner from the toner tank **422**, and a feed roller **426** disposed in opposing relation to the toner roller **424**. The fixing device **404** consists of a pair of pressure rollers **428** an a back-up roller **429**.

On the downstream side of the fixing device **404** are disposed a delivery passage **430** for guiding the sheet of copying paper **86** having been subjected to fixing process, a slope **432** for guiding the sheet **86** passed through the delivery passage **430**, and a paper stacker **434** which has an opening provided in the front side of the copying machine **12**.

It should be noted that, in FIG. **23**, reference numeral **436** denotes a guide plate for guiding each sheet of copying paper **86**, and reference symbol P.L denotes a path line of the copying paper **86**.

In addition, the feed rollers **406** in the paper feed section **394**, the driving shaft **410** in the exposing drum **84**, the feed rollers **420**, **426** and the toner roller **424** in the developing device **402**, and the pressure rollers **428** and the back-up roller **429** in the fixing device **404** are simultaneously driven by means of a power transmitted thereto from a driving gear (not shown).

(Control Section)

As shown in FIGS. **2** and **3**, a control keyboad **438** for controlling the projecting and recording apparatus is disposed on the projecting and recording apparatus body **10**. On the control keyboard **438** are disposed, e.g., control buttons and display means for displaying numerals and an operating state of the apparatus.

(Operation of the Embodiment)

The following is a description of the operation of the projecting, recording and copying apparatus in accordance with this embodiment. The presently preferred embodiment of the projecting, recording and copying apparatus has the following major functions: the reader function by which the image recorded on an electrophotographic film accommodated by a cassette is projected onto a screen on an enlarged scale; the camera and processor function by which a document is photographed and the thus-formed image is thereby recorded on the electrophotographic film accommodated by the cassette; and the copy function by which the image recorded on the electrophotographic film accommodated by the cassette is copied on a sheet of copying paper similarly on an enlarge scale. The functions will be described below in the above order.

The operation of loading a cassette into the apparatus will first be explained.

When the power switch of the apparatus is turned on, the stopper mechanism (not shown) retaining the cassette holder **360** is released, so that the second arm **368**, which are subjected to the biasing forces from the ten-

sion coil springs **365**, are pivoted clockwise from the position shown in FIG. **24** about their respective portions at which they are pivotally connected to the cassette holder brackets **362** and **364**, respectively, and the second arm **368** are thereby erected. In consequence, the other end portion of each of the second arms **368** is moved along the slot **382** formed in the cassette holder **360**, and one end portion of each of the first arms **366** is moved along the slot **378** formed in the corresponding cassette holder bracket **362** or **364**, thus causing the cassette holder **360** to be raised.

The cassette holder **360** causes the cover **372** to pivot against the biasing force from the torsion coil spring **393** while the rollers **370** are in rolling contact with the reverse side of the cover **372**. In this way, the cassette holder **360** forces the cover **372** to open and springs out of the housing **10**A of the projecting and recording apparatus body **10**. During this movement of the cassette holder **360**, the rotary damper **386** (shown in FIG. **17**) acts so as to generate damping force. There is therefore no risk of any impact being generated when the cassette holder **360** is stopped in the position shown in FIG. **24**A.

The cassette **14** is inserted into the cassette holder **360** in the direction of the arrow shown in FIG. **24**A. After the cassette **14** has been completely inserted into the cassette holder **360**, the cover **372** is pushed downward so as to be closed by a manual operation. As the cover **372** is moved downward, the second arms **368** are pivoted counterclockwise from the position shown in FIG. **24**A against the biasing forces from the respective tension coil springs **365**, and thereby flattened. In consequence, the first and second arms **366** and **382** are moved along the respective slots **378** and **382** in the reverse direction to the above, and the cassette holder **360** is thereby withdrawn into the housing **10**A of the projecting and recording apparatus body **10**, as shown in FIG. **24**.

When the cover **372** is moved back to the position at which it closes the opening **10**B provided in the housing **10**A of the projecting and recording apparatus body **10**, the cassette holder **360** is retained by the stopper mechanism (not shown). Accordingly, when the manual pushing operation is cancelled, there is no risk of the cassette holder **360** springing out. Thus, the loading of the cassette **14** into the projecting and recording apparatus body **10** is completed.

In this state, the cassette **14** is accurately positioned at a predetermined position in the projecting and recording apparatus body **10** by virtue of the positioning pins **388** and **390** shown in FIG. **23**. Further, when the cassette **14** is in this state, the cassette casing **16** is raised by the positioning pins **388** and **390** so that the reverse surface of the cassette casing **16** is separated from the bottom of the cassette holder **360** as shown in FIG. **17**. As the cassette casing **16** is moved upward from the bottom of the cassette holder **360**, the retainer members **374** are brought into pressure contact with the upper surface of the cassette casing **16**. Thus, the cassette casing **16** is resiliently held from the upper side thereof, and the electrophotographic film **28** is grounded through the projecting, recording and copying apparatus.

In the course of the cassette holder **360** being pushed in as described above, the guard pane **18** of the cassette **14** is brought into contact with a member (not shown) and thereby pivoted to the position shown by the chain line in FIG. **6**. Therefore, when the cassette **14** is in a loaded state, the tape **22** is exposed at the front side of the cassette casing **16**. The tubular member **194** is positioned within the recess **20** in the cassette casing **16** as shown in FIG. **18**, and the tape **22** is therefore positioned in a gap defined between the processing head **176** and the pressing plate **266**.

At the same time, the brake release pin **392** (see FIG. **22**) projecting upward from the cover **395** enters the through-hole **58** provided in the reverse surface of the cassette casing **16** to release the brake mechanism (not shown) which has locked the reels **32** from rotating. Therefore, when the cassette **14** is in a loaded state, the reels **32** are rotatable in both clockwise and counterclockwise directions. In this state, furthermore, the projecting walls **52** formed on the boss portion **46** of each reel **32** are engaged with the reel engaging projecting **293** formed on the corresponding reel table **292** shown, for example, in FIG. **23**.

The operation of positioning an electrophotographic film will next be explained.

In any case where an image is to be recorded on the electrophotographic film **28**, or an image recorded on the film **28** is to be projected or copied, a frame concerned is positioned in front of the charging exposure chamber **214** of the processing head **176**. Date concerning each of the frames on the electrophotographic film **28** has been recorded on the magnetic tape **26** spliced to the film **28** through the projecting and reproducing magnetic head **288**, and it is therefore possible to read the data through the magnetic head **288**.

To record or reproduce data, the solenoid **301** is energized so as to move the recording and reproducing magnetic head **288** in the direction of the arrow D shown in FIG. **23**. against the baising force from the compression coil spring **299**, and the magnetic head **288** is thereby brought into close contact with the magnetic tape **26**.

When a frame which is to be positioned at the charging exposure chamber **214** is determined, this frame is designated by actuating the buttons on the control keyboard **438**. In consequence, the motor **298** (see FIG. **22**) in the tape driving section shown in FIG. **23** is activated to rotate. The rotation of the motor **298** is transmitted to the first intermediate gear **304** through the gear **302** and further transmitted to the second and third intermediate gears **306** and **308**.

When the right-hand reel table **292** (as viewed in FIG. **23**) is caused to rotate as a driving reel table counterclockwise, i.e., in the arrowed direction, the gear **302** is rotated clockwise, i.e., in the arrowed direction. In response to the rotation of the gear **302**, the second intermediate gear **306** which is rotated counterclockwise together with the first intermediate gear **304** causes the third intermediate gear **308** to pivot counterclockwise about the axis of the pin **314**. In response to the pivotal movement of the third intermediate gear **308**, the oscillating plate **310** is also pivoted, and the third intermediate gear **308** is rotated clockwise. In this position, the third intermediate gear **308** is meshed with the gear **312** formed on the right-hand reel table **292** (as viewed in FIG. **23**), and the reel table **292** is thereby rotated through the third intermediate gear **308**.

When the left-hand reel table **292** (as viewed in FIG. **23**) is caused to rotate as the driving reel table in the clockwise direction, the gear **302** is rotated counterclockwise, i.e., in the direction opposite to the above, and the oscillating plate **310** is consequently pivoted in the reverse direction to the above, thus causing the

third intermediate gear **308** to mesh with the gear **312** formed on the left-hand reel table **292**.

When one of the reel tables **292** is rotated, one of the reels **32** which is engaged with this reel table **292** is rotated, and the tape **22** is wound up around this reel **32**. The tape **22** is unwound from the other reel **32**, and this reel **32** is rotated as a supply reel while being pulled by the tape **22**. Since an appropriate braking force is applied to each of the reel tables **292** by the associated band brake **320**, an appropriate back tension acts on the pulled tape **22** through the driven-side reel table **292**, so that there is no risk of the tape **22** sagging or being damaged.

It should be noted that the back tension is adjusted in such a manner that the motor **325** is driven to turn the cam plates **342** and **344** at a predetermined angle through the pulley **327**, the transmission belt **329**, the pulley **323**, the worm **321**, the worm wheel **356** and the shaft **352**, thus causing the band brakes **320** to apply an optimum braking force to the respective reel tables **292**.

More specifically, as the cam plates **342** and **344** are turned, the abutment pieces **338** are displaced following the large-diameter portions **346**, the intermediate-diameter portions **348** and the small-diameter portions **350**. Consequently, the arms **334** are pivoted in accordance with the amounts of displacement of the respective abutment pieces **338**, thereby controlling the tension of the tension coil springs **324**. The angle of rotation of the cam plates **342** and **344** is automatically controlled on the basis of the tape speed, and the amount of the tape **22** remaining on the supply reel **32**, etc. so that a substantially constant back tension is obtained.

Thus, the tape **22** starts to travel by rotating the reel tables **292**, and when the electrophotographic film **28** passes the processing head **176**, the passage of blip marks **34** each formed for one frame is sensed by the blip sensor **262**. In this embodiment, the number of sensed blip marks **34** is counted, and a designated frame is identified by an ordinal number counted from a starting frame. When the designated frame is positioned at the charging exposure chamber **214**, the drive of the motor **298** is stopped, and the rotation of the reel tables **292** is thereby stopped.

The following is a description of the operation of recording the image of a document on an electrophotographic film.

In this state, the document pressing plate **96** of the document table **64** shown, e.g., in FIG. **13** is first opened, and the document **66** (see FIG. **9**) is placed on the upper side of the glass plate **92** in alignment with the positioning marks **112** (see FIG. **14**) in such a manner that the side of the document **66** which is to be recorded faces downward. When the document pressing plate **96** is closed, the document **66** is fixed on the document table **64**, and the reverse surface and/or the periphery of the document **66** is covered with the white pressing sheet **102**. At this time, in order to form the image of the document **66** on the film, the third mirror **70** is moved downward and positioned between the guide rails **71** and **73**, thereby allowing for the switchover of the optical path.

When setting of the document **66** is completed, the camera mode is selected by actuating the buttons on the control keyboard **438**. When the camera mode is selected, the motor **154** shown, e.g., in FIG. **13** is driven, and the take-up pulley **144** is thereby rotated by means of the worm **156**, the worm wheel **152** and the shaft **146**. As the take-up pulley **144** is rotated, the wire **140** is unwound from the pulley **144** in such a manner that the wire **140** is extended while the intermediate portion thereof is being guided by the pulley **142**, thus causing the third mirror **70** to pivot clockwise from the position shown by the chain line in FIG. **13**. The motion of the motor **154** is stopped when the mirror frame **136** comes into contact with the lower limit switch **158**, and the third mirror **70** is stopped at the position shown by the solid line in FIG. **13**.

When the pivotal movement of the third mirror **70** is stopped, the information that the preparation for recording has been completed is displayed on the control keyboard **438**. When, in this state, the start button on the control keyboard **438** is pressed, the solenoid **284** shown in FIG. **21** is energized.

When the solenoid **284** is energized, the plunger **284**A is activated to move in the direction of the arrow F, causing the tension coil springs **281** and **282** to be expanded against the biasing forces. In consequence, the second lever **280** is pivoted on the shaft **279** in the direction of the arrow G, so that the first lever **227** is pivoted on the pin **278** in the direction of the arrow H, thus causing the shaft **275** to turn in the same direction. Thus, the arm **274** is pivoted in the direction of the arrow J so as to press the pressing plate **266** in the direction of the arrow K.

The pressing plate **266** is moved in the direction of the arrow K while the columnar portion **270** is being guided along the bore **272**, thus causing the electrophotographic film **28** to be pressed against the end faces of the projecting frames **212**, **220** and **246**. When the heightwise position of the film **28** is misaligned, the respective slanted surfaces **268**A and **269**A of the fitting members **268** and **269** act so as to push down the upper edge of the film **28** or push up the lower edge thereof as the pressing plate **266** is moved. While the pressing plate **266** is pressing the film **28** against the processing head **176**, the fitting members **268** and **269** are respectively fitted into the bores **271** and **272**, so that the film **28** is accurately positioned with respect to the processing head **176**. In this state, the pressing plate **266** is allowed to resiliently press the film **28** by the action of the tension coil springs **281** and **282**.

At the same time, a voltage is applied between the corona wire **216** and the corona electrodes **218** to generate corona discharge, thus causing the surface of the photosensitive layer **42** of the electrophotographic film **28** to be charged negative uniformly.

While the corona discharge is being carried out, the illuminating lamps **114** in the document illuminating device **68** are turned on to illuminate the document **66**. The light emitted directly from the illuminating lamp **114** and the light reflected from a reflecting plate **116** are allowed to illuminate the document **66** through the opening portions of the respective aperture masks **118**, so that the overall surface of the document **66** is uniformly illuminated. At the same time that the corona discharge is completed, the shutter **180** is opened, and an automatic exposure controller (not shown) starts integration of the quantity of light reflected from the document **66**. When the integrated value of the quantity of light reaches a predetermined value, the automatic exposure controller generates a signal to close the shutter **180**. At the same time, the controller generates a signal to turn off the illuminating lamps **114**.

While the shutter **180** is open, the light reflected from the document **66** in accordance with the pattern of the image thereof is made incident on the third mirror **70**,

passed through the second mirror **72**, the first mirror **74** and the main lens **76**, and illuminating the.surface of the electrophotographic film **28** by means of the optical system shown in FIG. **9**. Electric charge on the photosensitive layer **42** of the film **28** is reduced by the application of the light in accordance with the image pattern on the document **66**, and an electrostatic latent image is thereby formed on the photosensitive layer **42**.

Employment of the automatic exposure controller enables correction of factors in changes of the image density, such as variations in the ground density of the document **66** and variations in the voltage applied to the illuminating lamps **114**, so that an optimal exposure operation is effected at all times.

After the shutter **180** has been closed, the solenoid **284** is de-energized by means of a controller (not shown). In consequence, the second lever **280**, which is subjected to the biasing force from the tension coil spring **281**, is pivoted counter to the direction of the arrow G. The pivotal movement of the second lever **280** causes the arm **274** to pivot counter to the direction of the arrow J, so that the notched portion **274A** presses the stop ring **273A**, causing the pressing plate **266** to move counter to the direction of the arrow K so as to separate from the electrophotographic film **28**.

Thereafter, the motor **298** is activated to move the film **28** through a distance corresponding to one frame. Thus, the frame which has been exposed is moved and positioned in front of the developing chamber **224**. The amount of movement of the film **28** is controlled by sensing blip marks **34**. When the movement of the film **28** is stopped, the solenoid **284** is energized to activate the pressing plate **266** to press the film **28** against the processing head **176** in a manner similar to the above. At the same time, the suction squeezing pump **244** shown in FIG. **16** is activated to generate a negative pressure in the recesses **242**.

At the same time, the solenoid valve **230** is opened, and the developer which has been pumped up into the developer tank **232** from the developer bottle **238** by the action of the pump **236** is allowed to flow into the developing chamber **224** from the developer inlet **236**. The developer having flowed down through the developing chamber **224** is returned to the developer bottle **238** from the developer outlet **228**, and while doing so, the toner particles which are charged negative adhere to portions of the film **28** which are charged positive, thereby developing the electrostatic latent image. During the developing operation, the presence of the developing electrode **222** prevents occurrence of any edge effect.

The developer leaking out to the right and left sides of the projecting frame **220** of the developing chamber **224** is sucked in by the action of the suction squeezing pump **244** from the recesses **242**. When the solenoid valve **230** is closed, the supply of developer is stopped and at the same time, the pressure squeezing pump **240** is activated to supply pressurized air to the developing chamber **224** from the developer inlet **226**, whereby surplus developer attached to, for example, the non-charged surface of the film **28** is blown off so as to be swished off.

The supply of the pressurized air by the pressure squeezing pump **240** is controlled in such a manner that a relatively weak blast is applied while a relatively large amount of developer remains in the developing chamber **224** in order to prevent deterioration of the quality of the image which would otherwise be caused by an operation in which the developer is blown off at high speed. When a predetermined period of time has elasped after the application of the blast has been started, a relatively strong blast is applied to increase the squeezing efficiency.

When the operation of the pressure squeezing pump **240** is stopped, the solenoid **284** is de-energized, so that the pressing plate **266** is separated from the electrophotographic film **28**. Thereafter, the motor **298** is activated to move the film **28** through a distance corresponding to one frame, and the developed frame is consequently positioned in front of the drying chamber **252**. When the movement of the film **28** is stopped, the solenoid **284** is energized to cause the pressing plate **266** to press the film **28** against the processing head **176**. At the same time, warm air is blown out from the warm air outlet **254**, and the developer remaining on the film **28** is thereby dried.

When the application of warm air is completed, the pressing plate **266** is separated from the film **28** in a manner similar to the above. Thereafter, the film **28** is moved by an amount corresponding to one frame, and the frame concerned is thereby positioned in front of the fixing chamber **258**. After the film **28** has been pressed against the processing head **176** by means of the pressing plate **266** in the same way as the above, the xenon lamp **260** is turned on, so that the toner particles are fused and fixed to the surface of the film **28** by the energy radiated from the lamp **260**. Thereafter, the pressing plate **266** is separated from the film **28** in the same manner as the above.

Although each process has been described about only one frame of the electrophotographic film **28** by way of example, it is also possible to continuously effect recording on consecutive frames. In this case, these frames are simultaneously subjected to different kinds of processing, respectively.

The following is a description of the operation of projecting and copying an image recorded on the electrophotgraphic film by means of the optical systems shown in FIGS. **10** and **11**.

In this case, a frame on the film **28** which is to be projected is positioned in front of the charging exposure chamber **214** of the processing head **176**. In the system according to the presently preferred embodiment, the reader mode has been automatically selected when no button on the control keyboard **438** is actuated. In the reader mode, the third mirror **70** stands by in the position shown by the chain line in FIG. **13** in which the mirror **136** is in contact with the upper limit switch **160**.

When the start button on the control keyboard **438** is pressed, the shutter **180** is opened, and the halogen lamp **184** in the projecting light source section **78** is turned on. In addition, the cooling fan **200** is activated. The light from the halogen lamp **184**, together with the light reflected by the reflecting plates **186**, is condensed by the condenser lens **188**, reflected by the lower projecting mirror **190** so as to travel upward, condensed again by the condenser lens **196** and then reflected by the upper projecting mirror **198** so as to reach the rear surface of the electrophotographic film **28**.

It should be noted that the lower projection mirror **190** is defined by a cold mirror which transmits heat rays, and therefore the light reaching the film **28** has a relatively low temperature.

The light having reached the film **28** is transmitted through the same, and the image recorded on the film **28** is formed on the first mirror **74** by the main lens **76**.

The optical image formed on the first mirror **74** is reflected therefrom so as to reach the second mirror **72**, and the image is further reflected by the mirror **72**, transmitted through the screen **80** and projected thereon.

In the reader mode, it is possible to continuously view projected images of the film **28** within a short period of time by continuously advancing the frames of the film **28** through the operation of the buttons on the control keyboard **438**. In this case, every time each frame of the frame **28** is caused to advance, the shutter **180** is closed, so that the occurrence of flickering resulting from the phenomenon of afterimage can be prevented. Also, at this time, the movable **61** rests on the uppermost portions or the lowermost portions of the guide rails **71** and **73**.

The operation of copying an image recorded on an electrophotographic film by the optical system shown in FIG. **11** will be explained below.

In this case, when the copy button on the control keyboard **438** is pressed while an image is being projected on the screen **80**, the driving gear in the copying machine **12** is activated, the movable mirror **61** is caused to move from the uppermost portions of the guide rails **71** and **73** to the lowermost portions of the same (or from lowermost to uppermost) by means of the previously-described mechanism and at the same time a movable member **85** formed with a slit is also caused to move in synchronism with the speed of travel of the movable mirror **61**, the exposing drum **84** being further rotated. In addition, as shown in FIG. **16**, the conversion lens **82** for slightly reducing the size of the image on the screen **80** is moved to a position between the main lens **76** and the first mirror **74**. Moreover, at the same time, the feed rollers **406** and the associated members of the copying machine shown in FIG. **25** are activated by the driving force applied through the driving gear.

Simultaneously, since the energization of the charging device **398** is started, the charging device **398** produces corona discharge through the corona wire **408**. The copying paper **86** in the shape of a roll is unwound by the action of the feed rollers **406** and transported to the exposing drum **84**. In the course of this transportion, the copying paper **86** is electrically charged directly below the charging device **398**. After the feed roller **406** has fed the copying paper **86** by a predetermined length, a clutch (not shown) is disengaged, so that the rotation of the feed rollers **406** is stopped. Immediately after that, the leading end portion of the paper **86** is cut in a sheet-like form by means of a cutter **396**.

Then, the sheet-like copying paper **86** which has been electrically charged all over the surface thereof is wound around the exposing drum **84** by a winding device (not shown). When the leading end of the copying paper **86** arrives at a predetermined position of the exposing drum **84**, this arrival is detected by a limit switch (not shown) disposed on the exposing drum **84**, and the drive of the driving gear in the copying machine **12** is stopped. Thus, when the motion of the driving device has been stopped, the movable mirror **61** is caused to travel along the guide rails **71** and **73**.

At the same time that the copying paper **86** is stopped on the exposing drum **84**, the shutter **180** is opened for a predetermined period of time by the action of the automatic exposure controller (not shown), and an image recorded on the electrophotographic film **28** is formed on the first mirror **74** by the main lens **76** and the conversion lens **82**. The size of the optical image formed on the first mirror **74** is made slightly smaller than that as in the case of the reader mode by the action of the conversion lens **82**. The optical image is reflected by the first mirror **74** so as to reach the second mirror **72**, and the optical image reflected by the mirror **72** is further incident on the movable mirror **61**. When reflected by the mirror **61**, the optical image is formed in a slit-like shape on the copying paper **86** laid over the exposing drum **84**. An electrostatic latent image is formed on the thus-exposed copying paper **86**. In this case, since the exposing drum **84** is caused to rotate in synchronism with the travel of the movable mirror **61**, the electrostatic latent image is formed all over the exposed surface of the copying paper **86**.

When the shutter **180** is closed, the driving gear of the copying machine **12** is again activated to rotate the driving shaft **410** of the exposing drum **84**, so that the exposed copying paper **86** is transported to the developing device **402**. In the developing device **402**, the paper **86** is advanced into the gap between the toner roller **424** and the feed roller **426** by the action of the feed rollers **420**, and the toner attached to the peripheral surface of the toner roller **424** adheres to the exposed surface of the paper **86** to develop the electrostatic latent image.

The developed copying paper **86** is further advanced to the fixing device **404** where it is pressed by the pressure rollers **428** to fix the toner. The copying paper **86** passed through the fixing device **404** reaches the delivery passage **430** where it drops gravitationally, sliding on the slope **532**, and being discharged into the paper stacker **434**.

While the above provides a full and complete disclosure of the invention, various modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention. Therefore, the above description and illustrations should not be construed as limiting the scope of the invention, which is defined solely by the appended claims.

What is claimed is:

1. A projecting, recording and copying apparatus for use in an electrophotographic system, comprising:

an image-forming optical system for forming an image recorded on a film on a screen;

a movable mirror of a narrow width disposed between said screen and said image-forming optical system in such a manner as to be capable of traveling in the direction of its width and swiveling about its longitudinal axis so as to reflect a portion of the light rays transmitted through said image-forming optical system;

a drum disposed for free rotation about its axis and having a photosensitive material on the surface thereof;

a mirror moving device for moving said movable mirror in the direction of its width; and

a mirror swiveling device for swiveling said movable mirror about its longitudinal axis,

wherein the widthwise travel and the longitudinal swivel of said movable mirror enables focusing on said drum the light rays reflected from said movable mirror and at the same time focusing on said screen the light rays passing by said movable mirror, whereby both projection of an image onto said screen and recording of the same on said photosensitive material are performed at the same time.

2. A projecting, recording and copying apparatus for use in an electrophotographic system according to claim 1, wherein said mirror moving device is arranged to cause movement of said movable mirror in such a manner that a distance from said image-forming optical system through said movable mirror to said screen equals an optical path length from said image-forming optical system through said movable mirror to said drum, said mirror swiveling device being arranged to swivel said movable mirror in such a manner that the light rays reflected from said movable mirror is focused on the surface of said drum in the form of a strip parallel to the longitudinal axis of said drum.

3. A projecting, recording and copying apparatus for use in an electrophotographic system according to claim 1, wherein said mirror moving device causes said movable mirror to travel at a speed synchronized with the circumferential speed of said drum.

4. A projecting, recording and copying apparatus for use in an electrophotographic system, comprising:

an image-forming optical system for forming an image recorded on a film on a screen;

a movable mirror of a narrow width disposed between said screen and said image-forming optical system in such a manner as to be capable of traveling in the direction of its width and swiveling about its longitudinal axis so as to reflect a portion of the light rays transmitted through said image-forming optical system;

a drum disposed for free rotation about its axis and having a photosensitive material on the surface thereof;

a mirror moving device for moving said movable mirror so that, if l represents the length of a perpendicular drawn from a principal point of said image-forming optical system to said screen, θ representing the angle formed by said perpendicular and a straight line connecting said principal point and the center of said movable mirror, $l\sec\theta$ may represent the sum of an optical path length as between said principal point and the center of said movable mirror and an optical path length as between the center of said movable mirror and the center of said surface of said drum; and

a mirror swiveling device for swiveling said mirror in such a manner that a normal passing the center of said movable mirror normally passes the inner center of a triangle the vertexes of which are respectively constituted by the center of said movable mirror, the center of the surface of said drum and said principal point.

5. A projecting, recording and copying apparatus for use in an electrophotographic system according to claim 4 wherein, if R represents the radius of said drum, W representing the rotational speed of said drum and t representing the time, said mirror moving device causes movement of said movable mirror in such a manner as to fulfill the requirements represented by $l\tan\theta = R \cdot W \cdot t$.

6. A projecting, recording and copying apparatus for use in an electrophotographic system according to claim 4 further comprising a fixed mirror fixedly disposed between said movable mirror and said drum for reflecting the light rays reflected from said movable mirror and thereby forming an image on the surface of said drum.

7. A projecting, recording and copying apparatus for use in an electrophotgraphic system according to claim 4, further comprising a member including a slit which extends along the longitudinal axis of said drum, said member being disposed on the side of said drum upon which light rays are made incident.

8. A projecting, recording and copying apparatus for use in an electrophotographic system, comprising:

an image-forming optical system for forming an image recorded on a film on a screen;

a movable mirror of a narrow width disposed between said screen and said image-forming optical system in such a manner as to be capable of traveling in the direction of its width and swiveling about its longitudinal axis so as to reflect a portion of the light rays transmitted through said image-forming optical system;

a drum disposed for free rotation about its axis and having a photosensitive material on the surface thereof;

guide rail means each having a curve along which said movable mirror is made to travel so that, if l represents the length of a perpendicular drawn from a principal point of said image-forming optical system to said screen, θ representing the angle formed by said perpendicular and a straight line connecting said principal point and the center of said movable mirror, $l\sec\theta$ may represent the sum of an optical path length as between said principal point and the center of said movable mirror and an optical path length as between the center of said movable mirror and the center of the surface of said drum, and at the same time along which said movable mirror is made to swivel about its axis so that a normal passing the center of said movable mirror may normally pass the inner center of a triangle the vertexes of which are respectively constituted by the center of said movable mirror, the center of the surface of said drum and said principal point; and

slide means for allowing said movable mirror to slide along said guide rail means.

9. A projecting, recording and copying apparatus for use in an electrophotographic system according to claim 8, wherein said guide rail means comprise:

a first guide rail provided with a curve for allowing said movable mirror to swivel about its axis in such a manner that said normal passing the center of said movable mirror normally passes the inner center of said triangle the vertexes of which are respectively constituted by the center of said movable mirror, the center of the surface of said drum and said principal point; and

a second guide rail provided with a curve for allowing said movable mirror to travel therealong in such a manner that, if l represents the length of said perpendicular drawn from said principal point of said image-forming optical system to said screen, θ representing said angle formed by said perpendicular and said straight line connecting said principal point and the center of said movable mirror, $l\sec\theta$ may represent the sum of said optical path length as between said principal point and the center of said movable mirror and said optical path length as between the center of said movable mirror and the center of said surface of said drum.

10. A projecting, recording and copying apparatus for use in an electrophotographic system according to claim 9, wherein said movable mirror includes rod means and slide means, said rod means extending longitudinally from said movable mirror and having an axis

corresponding to the center of said movable mirror, said rod means being allowed to slide along said first guide rail with said slide means being allowed to slide along said second guide rail.

11. A projecting, recording and copying apparatus for use in an electrophotographic system according to claim **8**, wherein said movable mirror is urged with respect to said guide rail means by urging means.

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